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THE UNIVERSITY OF ALBERTA

INCOME CONTRIBUTION OF THE PETROLEUM INDUSTRY TO THE PROVINCE OF ALBERTA FOR THE PERIOD 1964-1976 AND PUBLIC POLICY

by

© H. D. SHARMA

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE

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THE UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance a thesis entitled Income Contribution of the Petroleum Industry to the Province of Alberta for the Period 1964-1976 and Public Policy submitted by H. D. Sharma in partial fulfilment of the requirements for the degree of Master of Business Administration

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Date March 20, 1979

ABSTRACT

The two-fold objectives of this study are to determine the magnitude of income contributions of the petroleum industry to the Province of Alberta and to examine the public policy implications arising out of these income contribution estimates. In order to provide a background for discussion, a review of the institutional arrangements relevant to petroleum industry has been made. This briefly describes the terminologies and government interactions with the petroleum industry. The income contribution of the petroleum industry to the Province of Alberta has been estimated by the equation $Y = (sE)\ (1/(1-pk))$. Here p is the portion of consumer spending retained in Alberta, k is the marginal propensity to consume and (sE) denotes the values of regional content of expenditures of the petroleum industry that contribute to Alberta economy. Finally, from public policy point of view, the leakages as reflected by the term, $s/(1-pk)$, from the petroleum industry expenditures have been discussed. Some recommendations are made to increase the income contributions of the expenditures of the petroleum industry to the Province of Alberta.

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CHAPTER I

INTRODUCTION

Over the period 1964 to 1976, the population of the province of Alberta increased by 28 percent to 1.8 million people. Over the same period, wages and salaries increased over 400 percent and the Gross Domestic Product increased overall by 423 percent. Corporate profits have increased even more dramatically by 594 percent. Of particular interest is the rapid growth in personal disposal income which increased by 330 percent. This means more is left to individuals for consumption of goods and services. These figures suggest that the Alberta economy has been very buoyant.

In the past forty years, there has been a major change in the structure of Alberta's economy. An analysis of the value-added to the economy by industries shows that the Alberta economy has changed from a basically agrarian economy to one in which mining and petroleum is currently the predominant industry. This is evidenced by the fact that in 1935, agriculture accounted for well over 50 percent of total net value of production, whereas in 1976 it accounted for only 13 percent. On the other hand, mining industry produced only 11 percent of net value in 1935 but in 1976 this figure increased to 53 percent. This dramatic change is due to the rapid growth of petroleum industry since 1947.

Cumulative investment in the Alberta petroleum industry to the end of 1976 was approximately 25.8 billion dollars. Since 1947, the sale of crown leases, reservations, royalties, rentals, permits and licences has provided the government an approximate 9 billion dollars. In 1976 alone such sales totalled 2.1 billion dollars. It, therefore, appears that oil and gas industry has been an important factor in the rapid dramatic economic growth in Alberta since 1947.

In the past, several studies have been made to estimate the income contributions of petroleum industry to the Province of Alberta. Caves and Holton (11) concluded that although a large amount of domestic product was created by the petroleum industry in Canada, its income impact was greatly diminished because of small cost of production, high profits and a high proportion of profits accuring to non-residents. Since a major portion of the Canadian petroleum production has taken place in Alberta, this conclusion is true for Alberta as well. Hanson (22, 23) and Weinrich (46), on the other hand, concluded that petroleum industry created a high income and employment impact in Alberta. Hanson's income contribution estimates go up to 1964 and Weinrich's estimates go up to 1965. A recent study by Singh (42) updates the income contribution estimates to 1970. He concludes that although the expenditures of the petroleum industry in Alberta have been very high, their income impact has been relatively small because of a large amount of leakages.

The two-fold objectives of this study are to determine the magnitude of income contributions of the petroleum industry to the Province of Alberta from 1964 to 1976 and to examine the public policy implications arising out of these income contribution estimates.

This thesis is divided into five chapters: Introduction, Institutional Arrangements, Theoretical Background, Estimates of Income Contribution of the Petroleum Industry and Public Policy Implications. Institutional Arrangement Chapter briefly describes the relevant terminologies and the government interactions with the petroleum industry. It summarizes such institutional arrangements as land and mineral rights, reservation system, the technology used in operations of the petroleum industry, the conservation system and the public policies relating to oil and gas industry. Public policies include government regulations regarding conservation and market allocation, environmental controls, transportation, processing and marketing. This Chapter will provide a background for the discussions in the following Chapters.

The Chapter on theoretical framework of this study discusses an economic and an accounting model used to estimate the income created by the petroleum industry in Alberta. This Chapter also discusses the procedure and calculations used to estimate the income multiplier for the petroleum industry expenditures.

After the basic institutional and theoretical framework has been established, income contribution estimates of the petroleum industry expenditures will be made. This will be done in Chapter IV.

Finally, the leakages from the petroleum industry expenditures will be discussed in Chapter V. Some recommendations will be made in this Chapter to increase the income contributions of the expenditures of the petroleum industry.

CHAPTER II

INSTITUTIONAL ARRANGEMENTS

This Chapter briefly describes the land and mineral rights, the reservation system, the technological aspects of the operations of the industry, the conservation system and the oil and gas policies of the government that are relevant to the Alberta economy. Hanson (22), and Hanson and Shaffer (24) discuss these and other aspects of oil and gas industry. In this Chapter the above aspects of institutional arrangements have been summarized.

2.1 Land and Mineral Rights

According to the royal grant, issued in 1670, the Hudson's Bay Company had the title to both the land and its mineral rights for almost all of the present day Western Canada. In 1869, the federal government purchased about 95 percent of this land including the mineral rights. The federal government gave the land and the mineral rights to C.P. railroads and homesteaders as an incentive to develop the West. The policy of giving these rights to C.P. railroads and homesteaders continued until 1887. Starting from this time, the government retained the mineral rights and only land was granted to homesteaders and land purchasers. In 1930, the federal government relinquished all the land titles in favor of the provinces but retained the mineral rights. This right is still retained by the federal government on Indian reserves, Territories and in a few isolated areas in the provinces (6 and 30).

The Government of Alberta presently owns approximately 81 percent of the mineral rights and the federal government about 9 percent of the mineral rights in the national parks and Indian reserves in Alberta. The remaining 10 percent is owned by freeholders (39). Thus

about 90 percent of mineral rights in Alberta are held by the Alberta Government and Alberta residents. Because of public ownership of such a large portion of energy resources, the Alberta Government has set up policies on entry, reservations and control of these resources.

2.2 Reservation System - Lease, Rentals and Royalties

In general, the Alberta Government policy has encouraged private industry to develop the provincial oil and gas resources. However, a proper method had to be set up to allocate these resources among private interests. This system of allocation is called the reservation system.

Alberta's reservation system stipulates that anyone, upon payment of a reservation fee of $250, and a performance fee of $2,500 for each of 20,000 acres parcel or a part thereof, can obtain drilling rights for a maximum area of 100,000 acres. Reservation holders normally have a period of three years in which they can explore for oil and natural gas. In this period they must pay to the province a rental of 10¢ an acre for each six months of the second and third years. If no oil or gas is found, the reservation reverts back to the province unless special permission is granted for an extension of the reservation at an increased rent. If oil and gas if found, the reservation holder is required to return as much as 50 percent of the reservation to the province. The province, then, gives the company a ten-year lease for the remainder of the reservation for the commercial production of oil and gas. A charge of one dollar per acre per year is paid by the user beginning second year. In the first year, this charge is only 50¢ per acre (39).

The above reservation system is applicable to the drilling rights awarded before July 1, 1976. This system was replaced by Petroleum and Natural Gas License Regulations effective July 1, 1976. According to the revised system, the offer for a license shall be accom-

panied by a fee of $500 and a rental for the first year of the term of the license. The annual rental for a license shall be $1.00 an acre payable in advance. The term of a license shall be two years where the location is in the northern area, and five years where the location is in the foothills area. Further details on these areas are described in Schedule A and Schedule B of Alberta Regulation 169/76 (35).

Once oil and gas are found, royalties on production become payable to the Government according to the Mines and Minerals Act. Petroleum Royalty Regulations are described in Schedule A and Schedule B of Alberta Regulation 93/74 (36). Natural Gas Royalty Regulations, that describe the method of royalty computations, are available in Schedules 1 to 4 of Alberta Regulation 16/74 (31).

After receiving the land from the reservation holder, where oil and gas was found, the leases on the land are offered to the highest bidders. The province, therefore, receives a portion of the economic rent arising out of the successful exploration.

The Federal Government's reservation system on the oil and gas resources under its jurisdiction is similar to that of the Alberta Government. Only minor variations exist between the two systems. For example, the Federal Government issues exploratory permits to eligible applicants for a period not to exceed six years instead of three years as is the case with the Alberta Government. If no oil or gas is found within the time limit, the land reverts back to the Federal Government. The lease holder can, however, apply for an extension of the lease beyond six years. If oil and gas is found, the leasing and bidding system for production are similar to that of the Alberta Government.

The north and northeast of Alberta has enormous quantities of tar sands from which synthetic crude oil can be extracted. These deposits are mainly located in Athabasca, Peace River, Wabasca and Cold Lake areas.

The oil sand deposits cover a total area of around 19,000 square miles. It is estimated to contain about 900 billion barrels of crude bitumin from which about 250 billion barrels of oil can be extracted (2). Unlike conventional crude reserves, the tar sands need not be discovered because they lie in well-defined and delineated areas. The province, therefore, has established a permit system to lease tar sand acreages. This system merely grants the lease-holder a potential right to set up a plant to produce synthetic crude oil. In order to build a plant, the lease-holder can then apply to the provincial government for approval.

In 1960, Great Canadian Oil Sands was granted permission to construct an oil sand extraction plant in Athabasca Oil Sands. In 1972, Syncrude, a consortium of Imperial Oil, Gulf Oil, Cities Services and Atlantic Richfield was given permission to build a plant of 125,000 barrels per day capacity. While granting permission, the government laid down certain conditions to increase Alberta and the Canadian content in design and construction phases of the plant.

In late 1974, Atlantic Richfield withdrew from the Syncrude consortium. The present share of corporate members in Syncrude now are: Imperial Oil Ltd. - 31 percent; Canada Cities Services Ltd. - 22 percent; Gulf Oil Canada Ltd. - 17 percent; Federal Government - 15 percent; Alberta Government - 10 percent; and Ontario Government - 5 percent (43). The participation of the Federal and Provincial Governments ensures greater Albertan and Canadian control of the oil industry. According to the agreement, instead of royalties, the Syncrude would provide 50 percent of its profits to the Alberta Government. The Alberta Government's share of profits will be tax deductible for federal income tax purpose (5). Applications by Shell Canada Ltd. to build a third plant in Athabasca Tar Sands and Imperial Oil to build an in-situ processing plant around Cold Lake area have been approved by the Alberta Government. These developments indicate a great potential for the development of Alberta tar sand resources.

2.3 Technological Aspects

Oil is generally found with natural gas and salt water. Sometimes soild hydrocarbon minerals are also found with oil. In most cases, oil appears to have been formed under marine conditions. However, in some cases it has been formed under deltaic conditions. Oil is rarely found at the point of its formation, since it is a fluid and migrates readily through pores, joints and bedding planes to other places (47).

Oil and gas are located in an underground chamber encased between layers of non-porous rocks. These chambers or traps may also contain water. Many chambers contain oil without gas, others oil without water, and some gas without oil. A typical trap consists of a layer of gas on top of a layer of oil which rests on a layer of water (24). When a well is drilled and the impervious rock is pierced, the high gas pressure pushes the oil up through the well and the oil gushes to the surface. As time passes, a reduction in the gas pressure results and the rate of oil and gas production decreases. Also, the recoverable quantity of oil from the well decreases. If the gas is dissipated too rapidly, not only production declines at a faster rate but also the total recovery of oil from the reservoir will fall. In order to maximize recovery from a given oil pool, attempts have been made to determine the optimal rate of production, i.e., the rate that would allow the gas pressure to fall in such a way that maximum possible quantity of oil is recovered. This rate is known as the "Maximum Efficiency Rate (MER)" or the "Maximum Permissible Rate (MPR)". Public authorities often use this rate as the basis for formulating conservation policies (24).

The oil that comes out of the well is known as crude oil. Processing of crude oil yields neptha, gasoline, kerosene, middle distillant and the residual fuel. Neptha is used as a feedstock to petrochemical plants, kerosene is used as jet fuel, middle distillant is used

for home heating (especially in Eastern Canada) and as a fuel for diesal engines. Finally, residual is used in running generators for utilities and heating large commercial buildings. Natural gas is used for home heating and as a fuel by utilities companies. Thus, natural gas is a substitute for the residual fuel.

Tar sand mining and extraction operations consist of land clearing, muskeg stripping, overburden removal, tar sand mining, extraction of bitumen from tar sand, tailings disposal and land reclamation. Basically, bitumen extraction from tar sand has four steps: (1) tar sand field conditioning, (ii) separation of the bitumen, (iii) waste disposal, and (iv) cleaning bitumen concentrate. Conditioning is done in a very short period of time by mixing tar sand with water and caustic soda at 180°F. The vessel used for conditioning is a slowly rotating drum into which steam is injected below the slurry surface. In the process the tar sand disintegrates liberating bitumen from sand and clay particles. The sand is water-wetted in its natural state and stays water-wet. This allows a clean separation of bitumen in the next process. The clays or layers inter-bedded with the tar sand do not ablate or disintegrate completely as the tar sand does but remain intact as lumps or balls of clay. In addition to clays, large pieces of rock are encountered in the tar sand which also remain as chunks. The slurry leaving the conditioning drum is passed over a vibrating screen. The unablated clays and the rocks are eliminated by this screening. All screen undersize drops into a sump and is delivered by 18 inch pumps into separation cell. In the separation process, the sand particles settle quickly to the bottom of the cell. The separated bitumen floats to the surface of the cell. At the present time, the details of the separation or any of the extraction processes are not known to the public. It is a part of the technology package which is jealously guarded as a secret (4).

Tar sands, that are deep below the ground surface and cannot be economically mined out, require in-situ extraction process. Details of this process are not publicly available. The basic idea behind this process is to inject steam through predrilled holes to push the oil up through the recovery wells. Imperial Oil intends to use this technology to recover heavy oil from the 48 metre thick clearwater sand, more than 330 metres below the ground surface in Cold Lake deposit (5).

2.4 Oil and Gas Policies

As discussed earlier, the Alberta and Federal Governments combined hold about 90 percent of the oil and gas rights in Alberta. This coupled with the fact that these exhaustible energy resources are important for provincial and national economy, government has set up policies regarding conservation and market allocation, environmental control, transportation, processing, marketing and other related factors. These items will be briefly discussed in this section.

2.4.1 Conservation and market allocation

Energy resources, such as crude oil and natural gas, are exhaustible. Therefore to get maximum benefits from these resources proper resource conservation mechanisms are required. With this objective in mind, Alberta Government instituted a conservation procedure, called the market-demand conservation method. This procedure was subsequently modified in 1969. According to the modified procedure the Energy Resources Conservation Board rations production among wells according to market demand. In order to determine the market demand, the Conservation Board holds hearings once a month. In these hearings, the buyers of crude oil present nominations, indicating the number of barrels they intend to purchase during demand. Further, the Conservation Board has a formula for allocating market demand to each well owner.

This allocation guarantees an economic allowance large enough to insure recovery of well completion and operating costs, provided this allowance does not exceed the well's MPR. The Board also grants additional allocations to wells using area as the criterion, e.g., larger the area drained by the wells, the greater the allocation (45). This system, thus, discourages drilling too many wells and inefficiency.

The Board has not attempted to prorate natural gas production for two reasons. Firstly, as bulk of the gas is produced along with crude oil, production restrictions on oil would imply restrictions on the gas production. Secondly, since mid 1950's, when it was realized that natural gas is a valuable resource, the pipeline companies have signed long term purchase agreements with the producers (21). Where Board does not attempt to restrict natural gas production, it controls flaring by issuing Gas Conservation Orders. Therefore, the Board permits flaring only when the incremental costs of gathering, processing and marketing of gas may exceed the cost proceeds (20).

2.4.2 Environmental controls

Oil and gas industry pollutes environment through oil spills, sulphur compound emissions in air by refineries, water pollution due to effluent discharge, contamination of groundwater, etc. (7). Therefore, the Government of Alberta and the Federal Government have imposed stringent regulations on the industry to minimize pollution. The concern for pollution is shown in a general policy of the government to institute an environmental impact study before a plant is given final approval. Findings of such a study play an important role in the government decision to give unconditional or conditional approval to build a plant. As an example, Alberta's Environment Minister asked Imperial Oil Ltd. to prepare an environmental impact report on its proposal to extract and upgrade oil from the Cold Lake Oil Sands. Imperial Oil was asked particularly to consider the impact of the plant on land use, wildlife,

water sources, disposal of water wastes, emission of sulphur compounds and impact on drainage, soils and vegetation (7). It appears that in future more and more environmental regulations will be imposed on the oil and gas industry.

2.4.3 Transportation

A network of oil pipelines move the Canadian crude oil to the refineries in British Columbia, Alberta, Saskatchewan, Manitoba, Ontario and the U. S. Prime components of this system are the trunk lines of the Interprovincial Pipe Line Company and the Trans Mountain Oil Pipe Line Company. Each of these lines start in Edmonton. Outside Alberta, the Interprovincial Pipe Line receives and transports Saskatchewan and Manitoba crude. The Trans Mountain transports British Columbia crude oil.

The Montreal refining center is served by a pipeline starting at Portland, Maine. This pipeline transports tanker-borne crude oil from Venezuela, the Middle East and Africa. The oil embargo of 1973 coupled with frequent price increases of off-shore oil, encouraged the Federal Government to have a policy of building a coast-to-coast pipeline network. As phase one of this policy, the Federal Government has decided to extend the existing Interprovincial Pipe Line system from Sarnia to Montreal. Construction of this line was completed in 1976. It started operating in June, 1976 (28).

Canadian natural gas must be processed before it is considered marketable. Gathering lines take raw gas from wells to the gas processing plant. Main transmission systems receive marketable gas from field gathering lines and/or plants. Finally, they transport gas to the market through trunk lines.

The Trans Canada Pipelines System, that begins at Alberta border near Burstall, Saskatchewan, delivers gas to Eastern Canada and the U. S. markets. The West Coast Transmission Company Ltd.'s lines extend from Fort Nelson in British Columbia to Sumas on the B. C. - U. S. border, near Vancouver. This West Coast Transmission pipeline system carries gas from producing areas in B. C., Western Alberta and Northwest Territories and delivers it to B. C. and Western U. S. The Alberta Gas Trunk Line Company Limited transports most of Alberta's export gas from producing fields to the provincial boundaries where it is delivered to an interprovincial transmission pipeline, for delivery to markets in and outside Canada.

In 1974, National Energy Board issued a set of gas pipeline regulations. These regulations were subsequently revised in consultation with the industry and related authorities. The Board's practice and procedures were amended to include requirements regarding Canadian content and environmental controls (14).

2.4.4 Processing

In the past, the location and size of Canada's refineries were primarily determined by the proximity and the size of the market. Thus approximately 58% of the total capacity is located within the populous regions of southern Ontario and Quebec. A recent trend has been to increase the size of the refineries to affect economies of scale. The Provinces of Alberta, Saskatchewan and Manitoba were previously served by a number of small refineries located close to individual cities but many of them are being phased out. They are replaced by two large refineries in Edmonton. These refineries are located close to the main sources of crude oil in Alberta. Construction of large refineries in Atlantic Provinces is encouraged by their proximity to deepwater ports where crude input is received by tanker. Thus, the present trend of increasing the

size of refineries and building new ones close to the sources of crude oil, will confine environmental problems to a small area, and facilitate pollution control. As of 1976, Alberta had six refineries with a total capacity of 41,700 m^3/d. This capacity is 12.6% of the total Canadian refining capacity. By the end of 1978, 4800 m^3/d additional capacity will be added to the existing facilities by building new refineries in Alberta. Further expansion of a few of the existing refineries in Alberta is also in progress (16).

2.4.5 Marketing

According to the National Energy Borad (NEB) October, 1974 report on exports of oil, oil production would decline from established oil fields starting in 1975. This decline would continue until 1980's, until oil from North and Alberta oil sands became available. Therefore, the overall national oil deficit in 1982 was predicted to be 200,000 barrels/day. The NEB, therefore, recommended that exports of crude oil and petroleum products should be progressively reduced.

The amount of oil, that can be exported, is computed annually with the help of a system of monthly licenses to ensure that Canadian requirements are met (18). Table 2.1 below shows the amount of oil permitted by NEB for exports for different years (8).

TABLE 2.1 OIL EXPORT LIMITATION BY NATIONAL ENERGY BOARD

Period	Export Limit (b/d)
1975 (first half)	800,000
1975 (second half)	750,000
1976 (average)	460,000

Since late 1973, the Organization of Petroleum Exporting Countries, OPEC, has quadrupled the international price of oil. After this the Canadian government instituted a voluntary price constraint on petroleum products. A new national oil policy was outlined in December, 1973. In January 1974, the provincial governments agreed to a single-price oil policy in Canada. This policy allows Canadians to purchase oil at a lower than international price. This subsidiary provided by the government is recovered by a high price charged for the exports. Adoption of the Petroleum Administration Act in June 1975, authorized the Federal Government to set price of oil and gas domestically as well as for the export. The domestic price schedule is given below in Table 2.2 for different years (18).

TABLE 2.2 DOMESTIC OIL PRICE IN CANADA

Period	Price ($/b)
Sept. 1973	3.80
April 1974	6.50
July 1975	8.00
July 1976	9.05
Jan. 1977	9.75
Jan. 1978	11.75
July 1978	12.75

In response to the major increase in international oil prices in Fall, 1973, Alberta Government enacted the Petroleum Marketing Act in January 1974 and announced its intention to set up a provincial marketing board. The Provincial Government intended to control the production, marketing and pricing of Alberta oil and gas. Similar legislations were subsequently enacted by Saskatchewan and British Columbia. In 1974, Alberta Government introduced an incremental royalty program averaging

65 percent of the increased price of old oil. This increased the average royalty on oil from 22 percent to 42 percent. The Alberta Government also encouraged exploration and development of hydrocarbons within its borders by giving additional incentives. In 1975, it reduced its royalty rate from 65 percent to 50 percent on the portion of the price between $6.50 and $8.00 per barrel. This reduced the average royalty rate on oil from 42 percent to 36 percent.

The Government of Canada also introduced changes in its tax structure to encourage exploration. In 1976, the tax rate was reduced to the general corporate income tax rate, on oil and gas industry, of 46 percent from 50 percent. Further energy development incentives were also given in Federal Government's budget of April 10, 1978. The details of these incentives will be summarized in the following section of this Chapter.

Local and provincial natural gas utility companies purchase gas from major pipeline companies and operate their own pipeline systems to sell gas to the public. In order to satisfy Canadian demands first, the Federal Government has decided that future exports have to comply with 1975 NEB report's recommendations. Accordingly, in the event of gas shortages, timing and amount of cutbacks would be determined only after consultation among the Federal and Provincial Government's and the U. S. Government (10).

At the time of 1974 hearing into the pricing of Canadian natural gas, export prices were found to be unrealistically low. Therefore, the NEB recommended that natural gas exported to the U. S. should be priced on the basis of a scarce and non-renewable natural resource. The NEB recommended that initially a new export price of $1 per thousand cubic feet (MCF) be established. The government also endorsed the NEB recommendation and followed the course of increasing gas prices. The proposed export price increases announced by the Minister of Energy,

Mines and Resources are summarized in Table 2.3. The proposed domestic price increases announced by the Federal Government are given in Table 2.4. These prices are at Toronto City - gate and are equivalent to 80 percent BTU value of the price of Crude Oil (32).

The Government of Canada feels that the price of natural gas in Canada should rise over a period of years to be competitive with oil on a delivered energy equivalant basis. Thus it is expected that the natural gas prices will continue to increase if oil prices go up.

2.4.6 Energy development incentives in 1978 federal budget

The federal budget of April 10, 1978, placed a high priority to the problem of energy supply and the need to become self-sufficient in oil and gas. Attention was focussed upon the heavy oil reserves and oil sands deposits of the Western Provinces. The development of these energy resources would require a big investment and a long lead time. To provide sufficient incentives for investments, it was announced that up-grading plants for processing the heavy oil would be treated as a manufacturing facility, eligible for fast write offs and a reduced tax rate. Further, to increase recovery, the budget increased the depletion rate from $1 for every $2 of expenditure compared to $1 for every $3 if enhanced recovery method was used (17).

For tax purposes, plants established to up-grade heavy oil, other than those established in connection with bituminuous sands mining projects, would be treated as manufacturing and processing facilities. This would qualify them for tax benefits available to oil refineries and manufacturer units (15).

TABLE 2.3 EXPORT PRICES OF NATURAL GAS[1]

Period	Price (Per MCf)
1974	$ 1.00
August, 1975	$ 1.40
November, 1975	$ 1.60
September, 1976	$ 1.80
January, 1977	$ 1.94

TABLE 2.4 DOMESTIC PRICES OF NATURAL GAS[1]

Period	Price (Per MCf)
1974	$ 0.82
November, 1975	$ 1.25
July, 1976	$ 1.405
January, 1977	$ 1.505

1. "New Export Price, Energy", Canada Year Book, 1976-77, pages 661-62.

The various institutional arrangements discussed above set a general scenario on land and mineral rights, reservation system, technological aspects and general oil and gas policies of the government. This background information on various aspects of oil and gas industry will form the basis for estimation of income contribution of petroleum industry to Alberta economy and its public policy implications. In the following chapters, first the theoretical background is reviewed. This is followed by the income estimation and a discussion of public policy implications.

CHAPTER III

THEORETICAL BACKGROUND

In this chapter, first, the economic and the accounting models used to estimate income contributions of the petroleum industry to Alberta economy will be reviewed. Then the parameters and the multiplier in the economic model, will be discussed and their values will be estimated.

3.1 Economic Model

Based on the Keynesian income model, Hanson (23) suggested a model to estimate incomes created by exports in a region. To illustrate the model, the regional income, Y, can be written in the following form:

$$Y = C+I+G+E-M \quad \text{---------- (3.1)}$$

where C = personal expenditure on consumer goods and services by the residents,

I = gross domestic investment in the region,

G = grovernment expenditure in the region,

E = exports from the region, and

M = imports into the region.

Further, if the basic source of regional income is indicated by F, and it consists of the non-resident funds spent in the region. Also, if the funds spent by the residents is denoted by R, then one can write

$$F+R = C+I+G+E \quad \text{---------- (3.2)}$$

From equations (3.1) and (3.2), the value of regional income, Y, can be obtained as shown below:

$$Y = F+R-M \text{ ---------- (3.3)}$$

or $$Y = (F-M_F) + (R-M_R) \text{ ---------- (3.4)}$$

where M_F = import content of expenditure from non-resident funds,
and M_R = import content of expenditure from resident funds.

From equation (3.4) one can obtain that:

$$\frac{Y}{(F-M_F)} = \frac{1}{1-\frac{(R-M_R)}{Y}} = m \text{ ----- (3.5)}$$

where $(F-M_F)$ is the primary regional income received by regional residents and $(R-M_R)$ is the secondary regional income generated by the expenditure of $(F-M_F)$. The multiplier or the regional generative ratio, m, is a measure of the leverage upon income of non-resident funds spent in the region and is indicative of the effects of import leakages. Thus, if there are different activities, say 1, 2, ----- n, and each has a multiplier m_1, m_2, ----- m_n, then the regional income can be expressed by the following equation (3.6).

$$Y = m_1 \ (F_1-M_{F1}) + m_2 \ (F_2-M_{F2}) + \text{-----} + m_n \ (F_n-M_{Fn}) \text{ ---- (3.6)}$$

According to Hanson (23) "there are all kinds of problems in estimating the many variables, and the data-gathering organizations of our society will have to adjust to them" if this model is used for regional income estimation. Another model, more amenable to the available data, is described below.

Let p be the portion of the consumption expenditures, C, retained in the region; then the imports required to provide the level of C is C(1-p). Similarly if q, r and s are the portions retained within the region out of the expenditures on gross domestic investment, I; the expenditures by the government, G; and the expenditures by non-residents, E; respectively. Then the total regional spending on imports, M, may be written as:

$$M = (1-p)C + (1-q)I + (1-r)G + (1-s)E \quad \text{---------- (3.7)}$$

From equations (3.1) and (3.7) one can get the following:

$$Y = pC + qI + rG + sE \quad \text{---------- (3.8)}$$

or $$\frac{Y}{sE} = \frac{pC + qI + rG + sE}{sE} = m^1 \quad \text{---------- (3.9)}$$

where m^1 is the export multiplier. According to expression (3.9) if (sE) generates income in the residentiary (secondary) sectors of the regional economy, then the regional income will be $(sE)m^1$. In this expression a given change in any of the variables in the numerator affects the value of the generative ratio, m^1. This change cannot be indicated without establishing certain functional relationships among them or without doing empirical work. Following is then an alternative method of expressing the multiplier.

If a dollar's worth of export, (E=$1) generates sE amount of income in the region in the first round. This then will generate further income as recipients spend on consumer goods. If k is the marginal propensity to consume the consumption expenditures incurred out of this (sE) will be equal to (ksE). As defined earlier if p is the portion of personnal expenditures retained in the region, then the regional income generated, in the second round of expenditures (ksE) will be equal to (pksE). The regional recipients of (pksE) will spend part of their re-

ceipts creating a regional income, in the third round, of (pk) (pksE), and so on. Total regional income, Y, will then be given by the following equation:

$$Y = (pk)sE + (pk)^2sE + (pk)^3sE + \text{----------} + (pk)^nsE$$

$$= sE \frac{1}{1-pk} \text{ if } (pk) < 1 \text{ and } n \to \infty$$

$$Y = (sE) \frac{1}{1-pk} \text{ ---------- (3.10)}$$

where Y = regional income,

s = portion retained regionally out of expenditures by non-residents,

E = exports,

p = portion of the personal expenditure, C, retained in the region and is equal to (1-M), where M is imports,

k = ratio of incremental consumer spending to incremental income received $= \frac{\partial C}{\partial Y}$ and is equal to $\left(1-\frac{\partial S}{\partial Y}\right)$, where S is regional is regional savings or $\frac{\partial C}{\partial Y} + \frac{\partial S}{\partial Y} = 1$

This is called marginal propensity to consume, and,

$\frac{1}{(1-pk)}$ = generative ratio or the multiplier.

Thus, the contribution of each export activity, E, to the regional income, Y, can be determined if the values of parameters s, p and k can be estimated.

The model presented above has been used by Singh (42) to estimate the income contribution of petroleum industry to the Province of Alberta.

Thus, a dollar's worth of export creates $s/(1-pk)$ amount of income. The parameters, that need to be estimated in this model, are marginal propensity to consume and the regional contents of the expenditures of the petroleum industry and consumers. As will be discussed in Section 3.3, the values of p and k and hence the multiplier can be estimated fairly accurately. Therefore, this model is not beset by econometric estimation problems.

3.2 Accounting Model

The accounting model for estimating income contributions of the petroleum industry to Alberta as devised by Singh (42) is presented below. Total expenditures of the petroleum industry can be divided into production and capital expenditures. The accounting equation for production or sales requires that the total receipts of the petroleum industry for a particular period, must equal its production expenditures plus profits for that period. Similarly, equation for the capital budget requires that capital expenditures must equal the funds raised internally and externally assuming that none of these funds are retained. As the income estimating model used in this study requires that the regional content of the expenditures of the petroleum industry is estimated, it is imperative that the expenditures, and not the receipts of the petroleum industry, are used for estimating the income contributions.

The total income contributions of the petroleum industry will be sum of the income contributions of production expenditures and capital expenditures made by the petroleum and the petroleum dependent industries. This can be written as:

Total income contributions of the petroleum industry to Alberta
= Total net income contributions of (production expenditures + capital expenditures + petroleum dependent industries' expenditures + petroleum industry payments to Alberta government) .... (3.11)

where:

Total net income contributions of production expenditures
= (total sales-imported inputs - taxes to the Alberta and the Federal Governments - interest and dividend payments to non-residents - service payments to non-residents - retained earnings - depreciation) x multiplier ---------- (3.11a)

Since retained earnings and depreciation are used to finance capital expenditures, they have been subtracted from production expenditures and added to capital expenditures below:

Total net income contributions of capital expenditures
= (depreciation + retained earnings + net inflow of foreign funds + new equity and borrowings from the domestic market - imported inputs - petroleum industry payments to the Alberta and the Federal Government) x multiplier ---------- (3.11b)

Income contributions made by the petroleum dependent industries will also consist of production and capital expenditures. Adjustments for import content and tax payments for these expenditures will be made similar to the ones shown above in equations (3.11a) and (3.11b).

Income contribution of the petroleum industry payments to the Alberta Government = (total petroleum industry payments to the Alberta Government - imported inputs) x multiplier.

3.3 Parameter Estimation

The theoretical model described in section 3.1 required that the three parameters, marginal propensity to consume (k), portion of consumer spendings retained in Alberta (p) and the portions retained regionally out of the expenditures by non-residents (s) need to be estimated so that equation (3.10) could be used for income estimation.

3.3.1 Estimate of marginal propensity to consume, k

Marginal propensity to consume (MPC) is defined by the following relationship:

$$C = a_o + kY \quad \text{---------- (3.12a)}$$

or

$$k = \frac{\partial C}{\partial Y} \quad \text{---------- (3.12b)}$$

where a_o is a constant and C, k and Y have been defined earlier. From the data given in Appendix I, the value of k was estimated by using a linear time-series regression program.

The estimates of the equation and relevant statistics are given below:

$$C = 337.9 + 0.84Y \quad \text{---------- (3.13)}$$

	Coefficients	Standard Error	T-Value	R^2	D-W Statistics
Personal Disposal Income	0.84	0.015	53.6	0.997	1.9
Constant	337.9	102.4	3.3		

The estimated value of marginal propensity to consume, k, is 0.84 for Alberta and is close to available estimates for other similar regions as shown in Table 3.1 on following page.

TABLE 3.1 MARGINAL PROPENSITY TO CONSUME FOR DIFFERENT REGIONS[1]

Region	Values of marginal propensity to consume
Prairie Provinces	0.91
British Columbia	0.90
Ontario	0.90
Canada	0.94

3.3.2 Estimate of consumer spendings retained in Alberta

The regional content of the consumer's spending on goods and services, p, can be defined by the relationship given below:

$$p = \frac{\text{Consumer spending on goods and services produced in Alberta}}{\text{Total consumer spending on goods and services}} \qquad (3.14)$$

The estimated value of p is 0.63. Details of computations are presented in Appendix II.

3.3.3 Estimate of import contents of exports, s

The import contents of exports of the petroleum industry will not be estimated because different expenditures of the petroleum industry have been directly adjusted for their import contents. In other words, the value (sE) in equation (3-10) has been directly estimated in Chapter IV.

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1. Gillen, W. J. and Guccione, A., "Estimation of Post-War Regional Consumption Functions in Canada", Canadian Journal of Economics, May 1970, Pages 276-90.

3.3.4 Estimate of the multiplier

As discussed, the multiplier is (1/(1-pk)). The values of p and k have been estimated to be 0.63 and 0.84 in Appendix II and section 3.3.1, respectively. Based on these estimates of p and k the computed value of multiplier is 2.13. As p and k values remain the same, the multiplier values will also remain the same and apply equally to all industries including the petroleum industry.

CHAPTER IV

ESTIMATES OF INCOME CONTRIBUTIONS OF THE PETROLEUM INDUSTRY

As discussed in the previous Chapter, the income contribution of the petroleum industry to the Province of Alberta can be estimated by the equation $Y = (sE)\ (1/(1-pk))$. Here p is the portion of consumer spending retained in Alberta and k is the marginal propensity to consume. Values of p and k for the Province of Alberta have been estimated in Chapter III. (sE) denotes the value of regional content of expenditures of the petroleum industry that contribute to Alberta economy. These expenditures consist of following six components:

1. operating expenditures
2. capital expenditures
3. transportation expenditures
4. oil refining expenditures
5. petrochemical industry expenditures
6. Alberta oil sands expenditures

In following sections, the values of these expenditures, from 1964 through 1976, will be compiled and their regional contents will then be estimated. Finally, the income contribution of the petroleum industry to the Alberta economy will be estimated.

4.1 Operating Expenditures

Periodically, Statistics Canada, in co-operation with the Central Accounting Committee of the Canadian Petroleum Association has undertaken surveys of the exploration and production activities of 20 major oil and gas companies operating in Canada (44). Detailed data collected from these companies including their expenditures are classi-

fied into categories. This information is then published in The Crude Petroleum and Natural Gas Industry's Annual Catalogue. According to this publication, the operating expenditures of oil and gas industry have been divided into following four categories:

(i) expenditures incurred on geological and geophysical operations,

(ii) expenditures incurred on field and well operations,

(iii) expenditures incurred on natural gas processing plant, and

(iv) expenditures incurred on other operations.

4.1.1 Expenditures incurred on geological and geophysical operations

These expenditures have been broken down into salaries and wages, materials and supplies, and contractor and service payments. They are presented in Table 4.1. In rows 5, 6 and 7 of Table 4.1 are given the percent breakdowns of these expenditures. In order to estimate the regional content of these expenditures, it has been assumed that the industry employs Alberta residents and therefore salaries and wages have 100 percent of regional content. Even if some of the employees are recruited from outside the province, these employees become resident in Alberta and spend most of their income locally. Further, it has been assumed that materials and supplies, and payments to contractors for services have 50 percent regional content because geological and geophysical operations require imported technology and materials. This has been discussed at some length in Chapter V, when leakages due to imported goods and services, and payments for dividends interests and services to non-residents are discussed in Section 5.1.

TABLE 4.1 OPERATING EXPENDITURES - GEOLOGICAL & GEOPHYSICAL OPERATIONS

(MILLIONS OF DOLLARS)

	Year	1964	1965	1966	1967	1968	1969[2]	1970[2]	1971	1972[2]	1973[2]	1974[2]	1975[2]	1976
(1)	Salaries and Wages[1]	14.72	16.04	25.97	32.17	23.03	-	-	16.77	-	-	-	-	34.74
(2)	Materials & Supplies[1]	2.35	2.69	4.36	6.52	5.82	-	-	2.93	-	-	-	-	9.58
(3)	Contractor & Service Payments,[1]	20.33	23.36	37.83	61.04	58.30	-	-	45.83	-	-	-	-	101.22
(4)	Total[1,3] (E_1)	37.40	42.09	68.16	99.73	87.15	86.40	80.34	65.53	71.16	70.66	112.39	99.03	145.54
(5)	Salaries & Wages as a Percent of Total	39	38	38	32	26	-	-	25	-	-	-	-	24
(6)	Materials & Supplies as a Percent of Total	6	6	6	7	7	-	-	4	-	-	-	-	7
(7)	Contractor & Service Payment as a Percent of Total	55	56	56	61	67	-	-	71	-	-	-	-	69

1. The Crude Petroleum and Natural Gas Industry, Statistics Canada, Catalogue 26-213, Annual from 1965-1976 inclusive. No individual reports were published for the years 1963 and 1964; 1965 report covers data for these years.

2. Breakdown is not available for the years 1969, 1970 and 1972 through 1975.

3. Canadian Petroleum Association, Statistical Handbook, 1976, Table 3A, Section IV, Item 1(a).

4. Total expenditure for the year 1964 is 32.0 million dollars as given in Canadian Petroleum Association, Statistical Handbook, 1976.

Based on these assumptions the total regional contents of expenditures, in percent and absolute values for geological and geophysical operations, have been computed for different years and are presented in Table 4.2.

4.1.2 Expenditures incurred on field and well operations

Field and well operations expenditures can also be broken down into salaries and wages, materials and supplies, and payments to contractor and for services. These expenditures have been summarized in Table 4.3. As discussed earlier, it has been assumed that salaries and wages have 100 percent regional content and payments to contractors and for services have 50 percent regional content. Materials required for field and well operations such as pipes, lubricants, building materials, etc., have a high regional content. Regional content of material and supplies have been, therefore, assumed 100 percent. Based on these assumptions the total weighted regional content of expenditures incurred on operation of wells is about 70 percent. These values for different years have been computed and are presented in Table 4.4.

According to Hanson's estimates of 1956, about 35 percent of the total cost of producing oil and gas consisted of wages and salaries. Approximately another 20 percent of these expenditures was estimated to have accrued to Alberta residents through the local purchase of fuel, electricity, material and supplies. Based on these assumptions, Hanson estimated that about 55 percent of operating expenditures on wells are retained within Alberta (22). In 1966, Hanson revised these values and estimated that the regional content varied between 55 percent to 60 percent. He further argued that this value "has tended to rise in recent years" (23). If the value of the regional content of these expenditures is assumed to be increasing linearly, then 67 percent would be the extrapolated value of regional content for 1976. This value is quite close to 1976 value of about 70 percent computed in Table 4.4.

TABLE 4.2 REGIONAL CONTENT FOR EXPENDITURES ON GEOLOGICAL & GEOPHYSICAL OPERATIONS

Year	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
(1) Salaries & Wages as a Percent of Total Expenditures[1]	39	38	38	32	26	-	-	25	-	-	-	-	24
(2) Material & Supplies as a Percent of Total Expenditures[2]	3	3	3	3.5	3.5	-	-	2	-	-	-	-	3.5
(3) Contractor & Service Payments as a Percent of Total Expenditures[2]	27.5	28	28	30.5	33.5	-	-	35.5	-	-	-	-	34.5
(4) Total regional content in percent ($100\ s_1$)	69.5	69	69	66	63	-	-	62.5	-	-	-	-	62
(5) Total expenditures[4] (E_1), Million Dollars	32.0	42.1	68.1	99.7	87.2	86.4	80.3	65.5	71.2	70.7	112.4	99.0	145.5
(6) Regional Content ($s_1 E_1$), Million Dollars	22.24	29.05	46.99	65.80	54.94	56.16	51.39	40.94	44.14	43.83	69.69	61.38	90.21

1. Assuming 100 percent regional content on salaries and wages.

2. Material and supplies, and service payments to contractor are assumed to have 50 percent regional content.

3. These percent values have been computed in Table 4.1; breakdown for the years 1969, 1970 and 1972 to 1975 are not available. For the years 1969 and 1970 regional contents are assumed to be 65 and 64 percent, respectively. For years 1972 to 1975 the regional content is assumed to be 62 percent.

4. Canadial Petroleum Association, Statistical Handbook, 1976, Table 3A, Section IV, Item 1(a).

TABLE 4.3 OPERATING EXPENDITURES - FIELD & WELL OPERATIONS

(MILLIONS OF DOLLARS)

	Year	1964	1965	1966	1967	1968	1969[2]	1970[2]	1971	1972[2]	1973[2]	1974[2]	1975[2]	1976
(1)	Salaries & Wages[1]	16.29	15.75	18.43	21.11	28.62	-	-	38.27	-	-	-	-	97.22
(2)	Materials & Supplies[1]	9.89	9.95	12.56	10.92	12.22	-	-	20.60	-	-	-	-	73.49
(3)	Contractor & Service Payments,[1]	41.32	41.70	50.58	47.97	54.86	-	-	81.19	-	-	-	-	262.99
(4)	Total Expenditure[1,3]	67.5	67.40	81.57[4]	80.00	95.70	94.2	119.4	140.10	164.7	215.10	241.4	328.3	433.70
(5)	Salaries & Wages as Percent of Total Expenditure	24.13	23.37	22.59	26.39	29.91	-	-	27.34	-	-	-	-	22.41
(6)	Material & Supplies as Percent of Total Expenditure	14.65	14.76	15.40	13.65	12.77	-	-	14.71	-	-	-	-	16.94
(7)	Contractor & Service Payments as Percent of Total	61.22	61.87	62.01	59.96	57.32	-	-	57.95	-	-	-	-	60.65

1. The Crude Petroleum and Natural Gas Industry, Statistics Canada, Catalogue 26-213, Annual from 1965-1976 inclusive. No individual reports were published for the years 1963 and 1964; 1965 report covers data for these years.

2. Breakdown is not available for 1969, 1970 and 1972 through 1975.

3. Canadian Petroleum Association, Statistical Handbook, 1976, Table 3A, Section IV, Item 3(a).

4. In Canadian Petroleum Association, Statistical Handbook, 1976, total expenditures for 1966 is given 77.2 million dollars.

TABLE 4.4 REGIONAL CONTENT OF EXPENDITURES ON FIELD AND WELL OPERATIONS

	Year	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
(1)	Salaries & Wages as a Percent of Total Expenditures[1]	24.13	23.37	22.59	26.39	29.91	-	-	27.34	-	-	-	-	22.41
(2)	Material & Supplies as a Percent of Total Expenditures[1]	14.65	14.76	15.40	13.65	12.77	-	-	14.71	-	-	-	-	16.94
(3)	Contractor & Service Payments as a Percent of Total Expenditures[2]	30.61	30.94	31.01	29.98	28.66	-	-	28.98	-	-	-	-	30.33
(4)	Total Regional Content in Percent ($100xs_2$)	69.39	69.07	69.00	70.02	71.34	-	-	71.03	-	-	-	-	69.68
(5)	Expenditures on Operations of Wells,[4] (E_2), Millions of Dollars	67.5	67.4	77.2	80.0	95.7	94.2	119.4	140.1	164.7	215.1	241.4	328.3	433.7
(6)	Regional Content @ 70 Percent (s_2E_2), Millions of Dollars	47.25	47.18	54.04	56.00	66.99	65.94	83.58	98.07	115.29	150.57	168.98	229.81	303.59

TABLE 4.4 REGIONAL CONTENT OF EXPENDITURES ON FIELD AND WELL OPERATIONS - (CONTINUED)

NOTES:

1. Assuming 100% of regional content on salaries and wages, and material and supplies.

2. The contractor and service payments are assumed to have 50% regional content.

3. These percent values have been computed in Table 4.3. As is evident from the table above that regional content values for different years are very close to their average value of 69.93, therefore for computational simplicity the regional content of 70 percent will be a reasonable value.

4. Canadian Petroleum Association, Statistical Handbook, 1976, Table 3A, Section IV, Item 3(a).

The regional content of operational expenditures on field and and well oeprations are presented in Table 4.4 for different years. These values do not differ significantly. Therefore, their average value of 70 percent for all the years is a reasonable estimate.

Total expenditures on operation of wells for different years have also been presented in Table 4.4. Assuming that regional content of these expenditures is 70 percent, as discussed above; the estimated regional content of operational expenditures is as presented in Table 4.4.

4.1.3 Expenditures incurred on natural gas processing plants

The operating expenditures of natural gas plants are summarized in Table 4.5. The breakdown of these expenditures into salaries and wages, materials and supplies, and payments to contractors and for services are also given in this table. As discussed earlier, salaries and wages, and materials and supplies required for operation of natural gas plants have 100 percent regional content. The payments to contractors and for services have been assumed to have 50 percent regional content. The total regional content of operational expenditures of natural gas plants have been computed on these assumptions and are presented in Table 4.6.

Hanson (22, 23) has combined the operating and capital expenditures for natural gas plants. In view of a high ratio of materials and equipment in refineries that are imported, Hanson estimated the regional content at 60 percent, for 1956 and 1966.

Values of regional content presented in Table 4.6 relate to operating expenditures only. Unlike capital expenditures, the expenditures are expected to have smaller import content. The regional content estimates in this study, therefore, have been estimated in the range of 74 percent to 78 percent. These estimates are higher in comparison to 60 percent value estimated by Hanson (22, 23).

TABLE 4.5 OPERATING EXPENDITURES - NATURAL GAS PROCESSING PLANTS

(MILLIONS OF DOLLARS)

	Year	1964	1965	1966	1967	1968	1969[3]	1970[3]	1971	1972[2]	1973[3]	1974[3]	1975	1976
(1)	Salaries & Wages,[1]	9.10	9.66	10.76	13.06	12.95	-	-	20.25	-	-	-	-	46.11
(2)	Materials & Supplies,[1]	7.53	8.36	9.30	13.45	15.83	-	-	19.45	-	-	-	-	51.35
(3)	Contractor & Service Payments,[1]	13.07	14.53	16.14	20.98	22.34	-	-	42.95	-	-	-	-	103.98
(4)	Total[1,2]	29.70	32.55	36.20	47.49	51.12	54.14	64.15	82.65	102.01	110.70	131.57	165.88	201.44
(5)	Salaries & Wages as a Percent of Total Expenditures	31	30	30	28	25	-	-	25	-	-	-	-	23
(6)	Materials & Supplies as a Percent of Total Expenditures	25	26	26	28	31	-	-	24	-	-	-	-	25
(7)	Contractor & Service Payment as a Percent of Total Expenditures	44	44	44	44	44	-	-	51	-	-	-	-	52

1. The Crude Petroleum and Natural Gas Industry, Statistics Canada, Catalogue 26-213, Annual from 1965-1976.

2. Canadian Petroleum Association, Statistical Handbook, 1976, Table 3A, Section IV, Item 3(b). The expenditures for 1964 in Table 3A are given 35 million dollars.

3. Breakdown of expenditures for these years is not available.

TABLE 4.6 REGIONAL CONTENT OF OPERATING EXPENDITURES ON NATURAL GAS PROCESSING PLANTS

	Year	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
(1)	Salaries & Wages as a Percent of Total Expenditures[1]	31	30	30	28	25	-	-	25	-	-	-	-	23
(2)	Material & Supplies as a Percent of Total Expenditures[1]	25	26	26	28	31	-	-	24	-	-	-	-	25
(3)	Contractor & Service Payments as a Percent of Total Expenditures[2]	22	22	22	22	22	-	-	25	-	-	-	-	26
(4)	Total Regional Content ($s_3 \times 100$)	78	78	78	78	78	-	-	74	-	-	-	-	74
(5)	Expenditures on Natural Gas Processing[4] (E_3), in Millions of Dollars	35.00	32.55	36.20	47.49	51.12	54.14	64.15	82.65	102.01	110.70	131.57	165.88	201.44
(6)	Regional Content ($s_3 E_3$), in Millions of Dollars	27.30	25.39	28.24	37.04	39.87	41.15	48.75	61.16	75.49	81.92	97.36	122.75	149.07

1. Assuming 100% of regional content on salaries and wages, and material and supplies.
2. The Contractor and service payments are assumed to have 50% regional content.
3. These percent values have been computed in Table 4.5. For the years 1969 and 1970 the regional content is assumed to be 76 percent and for years 1972 to 1975 it has been assumed to be 74 percent.
4. Canadian Petroleum Association, Statistical Handbook, 1976, Table 3A, Section IV, Item 3(b).

4.1.4 Other operating expenditures

These expenditures include other salaries and wages, materials and supplies, payments to contractor and for services, retention, royalties, taxes and interest expense. Retention refers to producing and non-producing acreage retention costs, bonuses paid for acquisition of freeholder's mineral rights, etc. The total amount of these expenditures are summarized in Table 4.7.

Based on the discussion in Section 2.1, about 90 percent of the mineral rights in Alberta are held by its residents. It is, therefore, reasonable to assume that retention and royalty payments have 90 percent regional content. Hanson (22, 23) has also used this figure for regional content of royalty payments for 1956, 1966. Other salaries and wages, materials and supplies, and taxes also have high regional content. Therefore, the regional content for these expenditures has been estimated at 100 percent. Payments to contractor and for services, and interest expense are expected to have high import content. Therefore, the regional content of these expenditures is assumed to be 50 percent. Leakages through interest payments to non-residents has been discussed in Chapter V.

Table 4.7 summarizes the expenditures for various items of other operating expenditures and the regional content in percentages. Retention and royalty payments are the major portion of the expenditures. Regional content estimates for these two payments are fairly accurate. A small error in the estimates of regional contents of other expenditures will not significantly affect the total income contribution estimates.

TABLE 4.7 OTHER OPERATING EXPENDITURES
(MILLIONS OF DOLLARS)

	Year	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
(1)	Salaries & Wages[1]	4.06	5.57	4.32	15.67	18.05	-	-	10.41	-	-	-	-	58.80
(2)	Materials, & Supplies,[1]	0.33	0.45	0.36	2.06	2.65	-	-	1.31	-	-	-	-	3.32
(3)	Taxes (Excluding Income Tax)[1]	6.5	8.27	8.57	9.62	10.82	12.11	12.44	15.23	17.65	19.21	58.72	75.10	96.89
(4)	Total Regional Content on Items: (1)+(2)+(3) @ 100%	10.89	14.29	13.25	27.35	31.52	12.11	12.44	26.95	17.65	19.21	58.72	75.10	159.01
(5)	Retention[1]	46.14	71.08	70.10	72.19	71.58	77.04	90.71	101.21	60.30	61.82	64.30	77.41	83.11
(6)	Royalties[1]	80.00	79.15	91.71	107.43	125.56	136.29	154.03	190.39	225.96	422.58	1,107.21	1,477.70	2,087.62
(7)	Total Regional Content on Items: (5)+(6) @ 90%	113.53	135.21	145.63	161.66	177.43	192.00	220.27	262.44	257.63	435.96	1,054.36	1,399.5	1,953.66
(8)	Contractor & Service, Payments,[1]	20.82	26.99	21.95	9.86	10.09	35.98[3]	23.42[3]	26.69	39.42[3]	43.49[3]	56.67	70.88	52.28
(9)	Interest, Expense,[1]	-	-	-	-	50.17	52.26	53.43	48.86	46.75	50.86	58.35	73.18	173.58

TABLE 4.7 OTHER OPERATING EXPENDITURES - (CONTINUED)

(MILLIONS OF DOLLARS)

	Year	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
(10)	Total Regional Content on Items: (8)+(9) @ 50%	10.41	13.49	10.97	4.93	30.13	44.12	38.43	37.78	43.09	47.18	57.51	72.03	112.93
(11)	Total Regional Content = (4)+(7) +(10) = (s_4E_4)	134.83	162.99	169.85	193.94	239.08	248.23	271.14	327.17	318.37	502.35	1,170.59	1,546.63	2,225.60

1. The Crude Petroleum and Natural Gas Industry, Statistics Canada, Catalogue No. 26-213, Annual, Items (13) through (19) both inclusive.

2. No information is available. Items left blank.

3. This has been described as other operating expenses in Table 5 of 1966 Catalogue No. 26-213. For the years 1969, 1970, 1972 and 1973, no information is available for salaries and wages, materials and supplies and contractor and service payments. Since contractor and service payments form major part, therefore, they have been lumped here.

4.1.5 Weighted average of regional content for operating expenditures

Regional content estimates of different components of operating expenditures vary depending upon the type of operations. Thus the regional content for geological and geophysical operations, ($s_1 \times 100$) vary from 62 to 69.5 percent, field and well operations ($s_2 \times 100$) from 51 to 62 percent, natural gas processing plant ($s_3 \times 100$) from 74 to 78 percent. Regional content estimates of other operating expenditures vary from 50 percent for contractor and interest payments to 100 percent for salaries and wages, materials and supplies and taxes. The weighted averages of regional contents for operating expenditures ($\bar{s}o$) for different years can be computed in the following manner:

$$\bar{s}o = \frac{\text{Total regional content of operating expenditures}}{\text{Total operating expenditures}}$$

$$\bar{s}o = \frac{s_1E_1 + s_2E_2 + s_3E_3 + s_4E_4}{E_1 + E_2 + E_3 + E_4} \qquad (4.1)$$

Values of s_1E_1, s_2E_2, s_3E_3 and s_4E_4 are given in Tables 4.2, 4.4, 4.6 and 4.7, respectively. Based on equation 4.1, above, the values of $\bar{s}o$ for different years (from 1964 through 1976) have been computed and are presented in Table 4.8. The weighted average values of regional content have been moderately increasing from 75 percent in 1969 to 83 percent in 1976. Alberta Government's policy of encouraging companies to utilize Albertan talents and facilities may be a major contributory factor for this increase.

TABLE 4.8 OPERATING EXPENDITURES - WEIGHTED AVERAGE VALUE OF REGIONAL CONTENT ($\bar{s}_o$)

Year	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
(1) s_1E_1 [1]	22.24	29.05	46.99	65.80	54.44	56.16	51.39	40.94	44.14	43.83	69.69	61.38	90.21
(2) s_2E_2 [2]	47.25	47.18	54.04	56.00	66.99	65.94	83.58	98.07	115.29	150.57	168.98	229.81	303.59
(3) s_3E_3 [3]	27.30	25.39	28.24	37.04	39.87	41.15	48.75	61.16	75.49	81.92	97.36	122.75	149.07
(4) s_4E_4 [4]	134.83	162.99	169.85	193.94	239.08	248.23	271.14	327.17	318.37	502.35	1,170.59	1,546.63	2,275.60
(5) $s_1E_1 + s_2E_2 + s_3E_3 + s_4E_4$	231.62	264.61	299.12	352.78	400.88	411.48	454.86	527.34	553.29	778.67	1,506.62	1,960.57	2,768.47
(6) $(E_1+E_2+E_3+E_4)$ [5]	292.45	333.57	382.95	444.02	522.89	548.45	597.90	682.34	727.99	994.39	1,830.59	2,367.43	3,336.26
(7) $\bar{s}_o = \frac{(5)}{(6)}$	0.79	0.79	0.78	0.79	0.77	0.75	0.76	0.77	0.76	0.78	0.82	0.83	0.83

1. From Table 4.2
2. From Table 4.4
3. From Table 4.6
4. From Table 4.7
5. The Crude Petroleum and Natural Gas Industry, Statistics Canada, Catalogue No. 26-213, Annual. ($E_1+E_2+E_3+E_4$ = Total Operating Expenditures).

4.2 Capital Expenditures

Based upon the data presented in the Crude Petroleum and Natural Gas Industry's Annual Catalogues, the capital expenditures of oil and natural gas industry can be divided into following three categories:

(i) expenditures incurred on exploratory and development drilling,

(ii) expenditures incurred on land sites and land acquisition, and

(iii) other capital expenditures.

4.2.1 Exploratory and development drilling expenditures

The total drilling expenditures have been broken down into salaries and wages, materials and supplies, and contractor and service payments (see Table 4.9). The regional content of these expenditures are presented in Table 4.10. The regional content percentages used in this estimation have already been discussed in Section 4.1.1.

4.2.2 Expenditures incurred on land sites and land acquisitions

As discussed in Section 2.1, almost all of the land titles and about 90 percent of the mineral rights are held by Alberta residents. It is, therefore, reasonable to assume that expenditures incurred on land sites have 100 percent of regional content. Further, the land acquisition expenditures consist of permit fees and other acquisition costs such as bonuses, legal fees and filing fees. These expenditures are related to the mineral rights. Thus regional content on land acquisition expenditures are estimated at 90 percent. The regional content estimates in dollars for land site and land acquisition for different years (from 1964 through 1976) are presented in Table 4.11.

TABLE 4.9 CAPITAL EXPENDITURES - EXPLORATORY AND DEVELOPMENT DRILLING
(MILLIONS OF DOLLARS)

Year	1964	1965	1966	1967	1968	1969[2]	1970[2]	1971	1972[2]	1973[2]	1974[2]	1975[2]	1976
(1) Salaries & Wages,[1]	10.67	11.23	10.61	8.96	8.11	-	-	6.79	-	-	-	-	48.66
(2) Materials & Supplies[1]	27.87	29.76	28.97	25.72	26.08	-	-	25.43	-	-	-	-	135.45
(3) Contractor & Service Payments,[1]	118.86	127.89	124.83	119.64	127.05	-	-	104.12	-	-	-	-	349.51
(4) Total[1,3]	157,400	168.88	164.41	154.32	161.24	157.35	155.84	136.34	171.24	233.12	282.84	361.41	533.62
(5) Salaries & Wages as a Percent of Total	6.78	6.65	6.45	5.81	5.03	-	-	4.98	-	-	-	-	9.12
(6) Materials & Supplies as a Percent of Total	17.71	17.62	17.62	16.67	16.17	-	-	18.65	-	-	-	-	25.38
(7) Contractor & Service Payments as a Percent of Total	75.51	75.73	75.93	77.52	78.80	-	-	76.37	-	-	-	-	65.50

1. The Crude Petroleum and Natural Gas Industry, Statistics Canada, Catalogue 26-213, Annual.
2. Breakdown is not available for the years 1969, 1970 and 1972 through 1975.
3. Canadian Petroleum Association, Statistical Handbook, 1976, Table 3A, Section IV, Items 1(b) and 2(a).

TABLE 4.10 REGIONAL CONTENT FOR EXPENDITURES ON EXPLORATORY & DEVELOPMENT DRILLING

	Year	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
(1)	Salaries & Wages as a Percent of Total Expenditures[1]	6.78	6.65	6.45	5.81	5.03	-	-	4.98	-	-	-	-	9.12
(2)	Materials & Supplies as a Percent of Total Expenditures,[2]	8.85	8.81	8.81	8.33	8.09	-	-	9.32	-	-	-	-	12.69
(3)	Contractor & Service Payments as a Percent of Total Expenditures[2]	37.75	37.86	37.96	38.76	39.40	-	-	38.18	-	-	-	-	32.75
(4)	Total Regional Content in Percent (100 s_5)	53.38	53.32	53.22	52.90	52.52	-	-	52.48	-	-	-	-	54.56
(5)	Total Expenditures (E_5), Millions of Dollars	157.40	168.88	164.41	154.32	161.24	157.35	155.84	136.34	171.24	233.12	282.84	361.41	533.62
(6)	Regional Content (s_5E_5), Millions of Dollars	83.42	89.51	87.14	81.79	83.84	81.82	81.04	70.90	90.76	123.55	149.91	191.55	288.15

1. Assuming 100 percent regional content on salaries and wages.
2. Material and supplies, and contractor and service payments are assumed to have 50 percent regional content.
4. The Crude Petroleum and Natural Gas Industry, Statistics Canada, Catalogue 26-213, Annual.
5. For the years 1969 and 1970 regional contents are assumed to be 52.50 percent. For years 1972 to 1975 the regional contents are assumed to be 53.52 percent.

TABLE 4.11 CAPITAL EXPENDITURES - REGIONAL CONTENT OF EXPENDITURES ON LAND SITES & LAND ACQUISITION

(MILLIONS OF DOLLARS)

Year	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
(1) Expenditures on Land Sites[1]	-	0.578	1.24	0.81	0.84	1.55	0.94	0.37	1.27	1.13	1.36	2.02	0.47
(2) Regional Content of Expenditures on Land Sites @ 100%	-	0.578	1.24	0.81	0.84	1.55	0.94	0.37	1.27	1.13	1.36	2.02	0.47
(3) Expenditures on Land Acquisition[1]	85.65	122.03	99.90	88.73	93.78	102.52	25.94	24.66	64.08	82.48	92.96	130.45	172.43
(4) Regional Content of Expenditures on Land Acquisition @ 90%	77.09	109.83	89.91	79.86	84.40	92.27	23.33	22.19	57.67	74.23	83.66	117.41	155.19
(5) Total Regional Content = (2)+(4) (s_6E_6)	77.09	110.41	91.15	80.67	85.24	93.82	24.27	22.56	58.94	75.36	85.02	119.43	155.66

1. The Crude Petroleum and Natural Gas Industry, Statistics Canada, Catalogue 26-213, Annual,

4.2.3 Other capital expenditures

These expenditures include tangible well and lease equipment, pipelines and related facilities, secondary recovery and pressure maintenance projects, natural gas processing plants and other building and machinery (44). Detailed breakdown of these expenditures into sub-categories such as salaries and wages, materials and supplies, and contractor and service payments are not given. Breakdown of these estimates, therefore, have been made in such a way that regional content of these expenditures can be derived. The procedure used for arriving at these estimates for the year 1976 are described below. Computations for other years are made following the same procedure.

Salaries and wages on capital expenditures
= 247.96 million dollars

Salaries and wages on drilling only
= 48.66 million dollars

Therefore, salaries and wages on other expenditures
= (247.96 - 48.66) million dollars
= 199.30 million dollars

The total value of other expenditures = 547.91 million dollars

Therefore, salaries and wages as a percent of total value of other expenditures

$$= \frac{199.30}{547.91} \times 100 = 36 \text{ percent}$$

Material and supplies for capital expenditures will have relatively low regional content because of less diversified Alberta economy and high technology used by the petroleum industry.

It has, therefore, been assumed that material and supplies have approximately 25 percent of regional content. Thus the regional content for contractor and service payments will be (100-36-25) = 39 percent. These values are computed similarly for different years and are presented in Table 4.12.

TABLE 4.12 CAPITAL EXPENDITURES - OTHER CAPITAL EXPENDITURES BREAKDOWN

(MILLIONS OF DOLLARS)

	Year	1964	1965	1966	1967	1968	1969[2]	1970[2]	1971	1972[2]	1973[2]	1974[2]	1975[2]	1976
(1)	Total Salaries & Wages on Capital Expenditures[1]	-	58.33	66.72	78.41	90.48	-	-	128.96	-	-	-	-	247.96
(2)	Salaries & Wages on Total Drilling,[1]	10.67	11.23	10.61	8.96	8.10	-	-	6.79	-	-	-	-	48.66
(3)	Salaries & Wages on Other Capital Expenditures = (1) - (2)	-	47.10	56.11	69.45	82.38	-	-	122.17	-	-	-	-	199.30
(4)	Other Capital Expenditures,[1]	81.00	88.51	98.87	162.91	172.05	201.50	254.74	320.21	262.63	247.87	317.63	347.65	547.91
(5)	Salaries & Wages on a Percent of Total (x)	53	53	57	43	48	45	41	38	37	37	37	37	36
(6)	Material & Supplies as a Percent of Total @ 25% Assumed	25	25	25	25	25	25	25	25	25	25	25	25	25
(7)	Contractor & Service Payments as a Percent of Total (x_1 = 100-x-25)	22	22	18	32	27	30	34	37	38	38	38	38	39

TABLE 4.12 CAPITAL EXPENDITURES - OTHER CAPITAL EXPENDITURES BREAKDOWN

(MILLIONS OF DOLLARS)

(CONTINUED)

NOTES:

1. The Crude Petroleum and Natural Gas Industry, Statistics Canada, Catalogue 26-213.

2. Breakdown of salaries and wages of total drilling is not available for the years 1969, 1970 and 1972 through 1975. Although the values of total salaries and wages on total expenditures for these years are available, they have not been put here because in absence of information on salaries and wages on drilling this information is of little use for these computations.

Breakdown of capital expenditures on oil and gas industry into machinery and equipment, and construction for Canada is available in Private and Public Investment in Canada (41). As an example, for 1976, machinery and equipment form 9 percent and construction forms 91 percent of the total capital expenditures. Since this information is not available for Alberta, it is assumed that the above percentages relating to Canada are true for Alberta. Estimates of these percentages, thus prepared, for different years are presented in Table 4.13.

As discussed in the earlier sections, regional content in salaries and wages is high because of high percentage of residents employed. Therefore, salaries and wages are assumed to have 100 percent regional content. Supply of materials such as, pipes, cement, building materials are locally available. Further, fuel and electricity have 100 percent Albertan content. However, materials and services, such as steel, machine parts, secondary recovery technology, etc., are imported. Thus, it is assumed that materials and supplies, and contractor and service payments have 50 percent regional content. The lack of diversification of Alberta economy is responsible for heavy import of machinery and equipment. Therefore, it is assumed that regional content of machinery and equipment is 25 percent.

Based on these assumptions total regional contents of other capital expenditures for 1976 are calculated in the following manner:

(a) Regional content for machinery and equipment
$= 9 \times 0.25 = 2.3\%$

(b) Regional content for material and supplies
$= 91 \times 0.50 \times 0.25 = 11.4\%$

(c) Regional content for contractor and service payments
$= 91 \times 0.50 \times 0.39 = 17.8\%$

(d) Regional content for salaries and wages
$= 91 \times 1.0 \times 0.36 = 32.8\%$

Total regional content of other capital expenditures
$= 64.3\%$

TABLE 4.13 CAPITAL EXPENDITURES FOR CANADA - MACHINERY & EQUIPMENT & CONSTRUCTION[1]

(MILLIONS OF DOLLARS)

Year	1964[3]	1965[3]	1966[3]	1967[3]	1968[3]	1969	1970	1971	1972	1973	1974	1975	1976
(1) Expenditures on Machinery & Equipment,[2]	-	-	-	-	-	76.6	71.3	89.6	91.2	84.3	165.3	211.3	194.5
(2) Expenditures on Construction,[2]	-	-	-	-	-	465.3	546.3	606.4	729.3	877.6	1,060.9	1,411.3	1,953.6
(3) Total Expenditures,[2]	-	-	-	-	-	541.9	617.6	696.0	820.5	961.9	1,226.2	1,622.5	2,148.1
(4) Machinery & Equipment as a Percent of Total (y)	11.6	11.6	11.6	11.6	11.6	14	11	13	11	9	13	13	9
(5) Construction as a Percent of Total (Z)	88.4	88.4	88.4	88.4	88.4	86	89	87	89	91	87	87	91

1. This breakdown is not available for Alberta. The total capital expenditures for Alberta are available. The ratios of machinery and equipment and construction computed here for Canada will be assumed to be applicable for Alberta.

2. Private and Public Investment in Canada, Statistics Canada, Catalogue 61-205, Annual, Table 2.

3. Information for these years is not available. The average precent values for 1969, 1970, 1971, 1972 and 1973 have been projected backwards for years 1964 through 1968.

Percentage values of the regional contents for different years were computed in the same manner and are presented in Table 4.14. The dollar amount of regional content of other capital expenditures are presented in Table 4.15.

4.2.4 Weighted average of regional content for capital expenditures

As discussed, the regional content for various components of capital expenditures vary. The regional contents for exploratory and development drilling ($s_5 \times 100$) are estimated to be between 52 percent to 54 percent, for land sites 100 percent, for land acquisitions 90 percent, and for other capital expenditures ($s_7 \times 100$) between 63 to 72 percent. For different years these values are presented in Tables 4.10, 4.11 and 4.14. The weighted average of regional contents for capital expenditures ($\bar{s}_c$) for different years can be computed by following formula:

$$\bar{s}_c = \frac{\text{Total regional content of capital expenditures}}{\text{Total capital expenditures}}$$

$$\bar{s}_c = \frac{s_5E_5 + s_6E_6 + s_7E_7}{E_5 + E_6 + E_7} \quad \text{---------- (4.2)}$$

Values of s_5E_5, s_6E_6, and s_7E_7 are given in Tables 4.10, 4.11 and 4.15, respectively. Based on equation 4.2 above, the values of $\bar{s}_c$ for years from 1964 through 1976 are presented in Table 4.16. Weighted average values of regional contents for capital expenditures over the years have either remained constant or have dropped slightly. A comparison of Tables 4.8 and 4.16 reveals that while regional content of operating expenditure has been increasing over the years, the capital expenditure counterpart does not show the same trend. This implies that Alberta's reliance on imports for capital expenditures has not decreased since 1964.

TABLE 4.14 REGIONAL CONTENT IN PERCENT FOR OTHER CAPITAL EXPENDITURES

	Year	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
(1)	Machinery & Equipment,[1]	2.9	2.9	2.9	2.9	2.9	3.5	2.8	3.3	2.8	2.3	3.3	3.3	2.3
(2)	Salaries & Wages,[2]	46.9	46.9	50.4	38	42.4	38.7	36.5	33	32.9	33.7	32.2	32.2	32.8
(3)	Material & Supplies,[3]	11.0	11.0	11.0	11.0	11.0	10.8	11.1	10.9	11	11.4	10.9	10.9	11.4
(4)	Contractor & Service Payments,[4]	9.7	9.7	7.9	14.1	11.9	12.9	15.1	16.1	16.9	17.3	16.5	16.5	17.8
(5)	Total Regional Content (100 s_7)	70.5	70.5	72.2	66	68.2	65.9	65.5	63.3	63.6	64.7	62.9	62.9	64.3

1. Regional content @ 25% of y. Values of y have been computed in Table 4.13.
2. Regional content @ 100% of (x) (Z). Values of x are computed in Table 4.12 and values of Z are computed in Table 4.13.
3. Regional content @ 50% of (25) (Z).
4. Regional content @ 50% of (x_1) (Z). Values of x_1 have been computed in Table 4.12 and values of Z are computed in Table 4.13.

TABLE 4.15 REGIONAL CONTENT OF OTHER CAPITAL EXPENDITURES
(MILLIONS OF DOLLARS)

	Year	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
(1)	Total Expenditures,[1] (E_7)	81.0	88.51	98.87	162.91	172.05	201.50	254.74	320.21	262.63	247.87	317.63	347.65	547.91
(2)	Regional Content,[2] (s_7E_7)	56.7	61.96	71.19	107.52	116.99	132.99	165.58	201.73	165.46	161.12	200.11	219.02	350.66

1. The Crude Petroleum and Natural Gas Industry, Statistics Canada, Catalogue 26-213.
2. Regional contents for various years have been computed in row (5) of Table 4.14.

TABLE 4.16 CAPITAL EXPENDITURES - WEIGHTED AVERAGE VALUE OF REGIONAL CONTENT ($\bar{s}_c$)

	Year	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
(1)	s_5E_5 [1]	83.42	89.51	87.14	81.79	83.84	81.82	81.04	70.90	90.76	123.55	149.91	191.55	288.15
(2)	s_6E_6 [2]	77.09	110.41	91.15	80.67	85.24	93.82	24.27	22.56	58.94	75.36	85.02	119.43	155.66
(3)	s_7E_7 [3]	56.7	61.96	71.19	107.62	116.99	132.99	165.58	201.73	165.46	161.12	200.11	219.02	350.66
(4)	$s_5E_5+s_6E_6+s_7E_7$	217.21	261.88	249.48	269.98	286.07	308.63	270.89	295.19	315.36	360.03	435.04	530.00	794.47
(5)	$(E_5+E_6+E_7)$ [4]	324.05	379.99	364.43	406.76	427.91	462.9	437.45	481.59	499.22	564.61	694.78	841.53	1,254.43
(6)	$\bar{s}_c = \frac{(4)}{(5)}$	0.67	0.69	0.68	0.66	0.67	0.67	0.62	0.61	0.63	0.64	0.63	0.63	0.63

1. From Table 4.10.
2. From Table 4.11.
3. From Table 4.15
4. The Crude Petroleum and Natural Gas Industry, Statistics Canada, Catalogue 26-213, Annual.
($E_5+E_6+E_7$ = Total Capital Expenditures).

4.3 Transportation Expenditures

Transportation expenditures are broken down into operating and the capital expenditures. Operating expenses include expenditures on maintenance, transportation and of general nature on trunk and gathering system. Breakdown of these expenses, into salaries and wages, materials and supplies, fuel and power, outside service, taxes excluding income tax and other expenses, are available in Oil and Pipeline Transport (34), except for the year 1966. Expenditures for 1965 and 1966 have been broken down into maintenance, transportation and general office. No information is available for the items such as, salaries and wages, materials and supplies. Based on the data available in Oil Pipeline Transport, the operating expenditures on transportation have been compiled and are given in Table 4.17. The estimated regional content in percentage of these expenditures are presented in Table 4.18.

Construction Canada (12), provides data on investments in Alberta consisting of gas mains and services, oil and gas pumping stations, storage tanks and pipelines. In view of high import content of these expenditures, a regional content of 40 percent on capital expenditures, as estimated by Hanson (23), has been used for these expenditures.

On the basis of above discussion, the total regional content of transportation expenditures for the period 1964 through 1976 was estimated and are presented in Table 4.19.

4.4 Oil Refining Expenditures

Oil refining expenditures are broken down into operating and investment expenditures. Detailed information on salaries and wages, cost of fuel and electricity, and cost of material and supplies of operating expenses are available in Petroleum Refineries (37).

TABLE 4.17 TRANSPORTATION EXPENDITURE - OPERATING EXPENSES TOTAL FOR CANADA

(MILLIONS OF DOLLARS)

	Year	1964	1965	1966[1]	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
(1)	Salaries & Wages,[1]	-	-	-	12.59	12.10	13.9	14.75	15.53	16.43	17.98	21.16	24.12	27.62
(2)	Materials & Supplies & Fuel Power,[1]	-	-	-	11.90	12.57	14.07	15.70	17.73	22.62	32.82	33.22	29.70	30.83
(3)	Outside Service,[1]	-	-	-	4.54	4.56	5.41	6.80	6.54	8.68	10.14	11.47	10.53	11.24
(4)	Other Expenses & Taxes Excluding Income Tax,[1]	-	-	-	13.57	16.36	16.22	18.15	19.70	21.77	23.46	29.25	33.85	40.08
(5)	Total,[1]	32.1	34.5	38.1	42.6	45.6	49.6	55.4	59.5	69.5	84.4	95.1	98.20	109.8
(6)	Salaries & Wages as a Percent of Total	-	-	-	29.55	26.56	28.02	26.62	26.10	23.64	21.31	22.25	24.56	25.34
(7)	Material & Supplies & Fuel as a Percent of Total	-	-	-	27.93	27.58	28.37	28.34	29.79	32.54	38.89	34.93	30.24	28.09
(8)	Outside Service as a Percent of Total	-	-	-	10.65	10.00	10.90	12.27	10.99	12.48	12.01	12.06	10.72	10.24
(9)	Other Expenses as a Percent of Total	-	-	-	31.87	35.86	32.71	32.77	33.12	31.34	27.79	30.76	34.48	36.33

1. Oil Pipeline Transport, Statistics Canada, Catalogue 55-201, Annual.
These expenses are total incurred on maintenance, transportation and general expenses on trunk and gathering system, Tables 9 and 10. Breakdown is not available for the years 1964, 1965 and 1966.

TABLE 4.18 REGIONAL CONTENT OF OPERATING EXPENDITURES
(IN PERCENT)

	Year	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
(1)	Regional Content of Salaries & Wages,[1]	-	-	-	29.55	26.56	28.02	26.62	26.10	23.64	21.31	22.25	24.56	25.34
(2)	Regional Content of Material, Supplies, Fuel & Power,[2]	-	-	-	13.96	13.78	14.18	14.17	14.89	16.27	19.45	17.46	15.12	14.04
(3)	Regional Content of Outside Service,[2]	-	-	-	5.32	5.00	5.45	6.13	5.49	6.24	6.00	6.03	5.36	5.12
(4)	Regional Content of Other Expenses & Taxes,[2]	-	-	-	15.93	17.93	16.35	16.38	16.56	15.67	13.89	15.38	17.24	18.16
(5)	Total Regional Content	-	-	-	64.76	63.27	64.0	63.3	63.04	61.82	60.65	61.12	62.28	62.66

1. Salaries and Wages are assumed to have 100 percent regional content.
2. Materials, supplies, fuel and power, outside service and other expenses and taxes are assumed to have 50 percent regional content.
3. Values for various items as a percent of total have been computed in Table 4.17.
4. Assuming that these percent make up of various items of the total operating expenditures are also applicable for Alberta.

TABLE 4.19 REGIONAL CONTENT OF TOTAL TRANSPORTATION EXPENDITURES

(MILLIONS OF DOLLARS)

Year	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
OPERATION													
(1) Canada's Operating Expenses,[1]	32.1	34.5	38.1	42.6	45.6	49.6	55.4	59.5	69.5	84.4	95.1	98.2	109.8
(2) Alberta's Share in Percent,[2]	45.3	46.1	46	48.4	48.9	51.2	53.1	55.6	59.8	63.3	62.7	61.6	61.0
(3) Alberta's Share in Dollars	14.45	15.87	17.5	20.5	22.3	25.3	29.4	32.7	41	53.2	58.9	60.8	66.98
(4) Regional Content,[3]	9.25	10.16	11.2	13.28	14.11	16.19	18.61	20.61	25.34	32.26	35.99	37.86	41.96
CAPITAL													
(5) Investment in Alberta,[4]	58.8	51.2	38.9	55	83.9	113.7	136.9	82.5	89.6	81.3	87.4	60.5	84.3
(6) Regional Content @ 40%	23.5	20.5	15.6	22	33.6	45.5	54.8	33	35.8	32.5	34.9	24.2	33.7
(7) Total Regional Content = (4) + (6)	32.75	30.66	26.80	35.28	47.71	61.69	73.41	53.61	61.14	64.76	70.89	62.06	75.66

1. Oil and Pipeline Transport, Catalogue #55-201, Annual.

2. Assuming Alberta's share is proportional to its share of operating revenue given in Oil and Pipeline Transport, catalogue #55-201, Annual, pages 5-6.

3. Percent regional content values for operations are computed in Table 4.18. For years 1964, 1965 and 1966 a regional content of 64 percent is assumed.

4. Contruction in Canada, catalogue #64-201 (pages 72-73 in 1974-76 catalogue). This includes gas mains and services, oil and gas pumping stations, oil and gas storage tanks and oil and gas pipelines.

This information has been summarized in Table 4.20. Salaries and wages will have a high regional content discussed earlier. Fuel and electricity will be available locally and will also have a high regional content. Therefore, regional contents for salaries and wages, and fuel and electricity are estimated at 100 percent. Crude oil, building materials and other general supplies required for refinery operations are locally available. However, equipment and machinery parts, and general maintenance materials and supplies are imported. Therefore, it has been estimated that regional content for materials and supplies is 50 percent. Total regional contents of oil refining operating expenditures, thus estimated, for different years are presented in Table 4.21.

Capital expenditures of oil refining are available in Construction in Canada (12). These expenditures consist of investments in oil refining as well as the investments in petrochemical investments. Hanson (23) estimated regional content on these expenditures 50 percent. Because of high technology used in refining and the lack of diversification of the Alberta economy there is a high reliance on imports. Therefore, regional content of capital expenditures in oil refining is estimated at 50 percent. Estimated regional contents of total refining expenditures are presented in Table 4.22.

4.5 Petrochemical Industry Expenditures

As discussed in Section 4.4, investment expenditures of petrochemical industry have been included in oil refining expenditures. This section will, therefore, discuss only the operating expenditures of petrochemical industry. These expenditures include those incurred on manufacturing of plastics and synthetic resins, paints and varnish, and industrial chemicals (organic) (3,40). The breakdown of these expenditures are presented in Table 4.23. This table includes the procedure for estimating regional content of operating expenditures of the petrochemical industry. Finally, the total regional content of petrochemical industry expenditures from 1964 through 1976 are summarized in Table 4.24.

TABLE 4.20 OIL REFINING EXPENDITURES - OPERATING EXPENSES

(MILLIONS OF DOLLARS)

	Year	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
(1)	Salaries & Wages,[1]	7.04	7.09	7.71	8.15	8.49	8.97	9.72	11.14	11.71	14.34	18.33	20.97	-
(2)	Cost of Fuel & Electricity[1]	1.92	2.04	2.06	1.86	1.97	2.01	2.05	2.74	3.26	3.63	4.79	10.12	-
(3)	Cost of Material & Supplies,[1]	93.35	103.29	106.62	112.67	117.09	126.76	130.61	152.58	179.70	235.71	408.65	608.77	-
(4)	Total Expenditures	102.31	112.42	116.39	122.68	127.55	137.74	142.38	166.46	194.67	253.68	431.77	639.86	959.79[2]
(5)	Salaries & Wages as a Percent of Total	6.88	6.31	6.62	6.64	6.66	6.51	6.83	6.69	6.02	5.65	4.25	3.28	-
(6)	Fuel & Electricity as a Percent of Total	1.88	1.81	1.77	1.52	1.54	1.46	1.44	1.65	1.67	1.43	1.11	1.58	-
(7)	Material & Supplies as a Percent of Total	91.24	91.88	91.61	91.84	91.80	92.03	91.73	91.66	92.31	92.92	94.64	95.14	-

1. Petroleum Refineries, Statistics Canada, Catalogue #45-205, Annual. These values are given in Table 1, Section 2 only for Alberta which includes establishments primarily engaged in refining crude petroleum (lubricating oil and greases do not contribute to any significant reportable values for Alberta). For the years 1964 through 1968, this information is available in Table 1, Section 1.

2. 1976 publication is not available at this time, a proportional increase in total expenditure has therefore been assumed., i.e., a 50 percent increase on the expenditures for 1976 over 1975 has been assumed.

TABLE 4.21 REGIONAL CONTENT OF OIL REFINING OPERATING EXPENDITURES

(PERCENT)

	Year	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
(1)	Salaries & Wages,[1]	6.88	6.31	6.62	6.64	6.66	6.51	6.83	6.69	6.02	5.65	4.25	3.28	-
(2)	Cost of Fuel & Electricity[1]	1.81	1.81	1.77	1.52	1.54	1.46	1.44	1.65	1.67	1.43	1.11	1.58	-
(3)	Cost of Materials & Supplies,[2]	45.62	45.94	45.80	45.92	45.90	46.01	45.86	45.83	46.15	46.46	47.32	47.57	-
(4)	Total Regional Content (%)	54.31	54.06	54.19	54.08	54.10	53.98	54.13	54.17	53.84	53.54	52.68	52.43	-

1. Assuming regional content for salaries and wages and fuel and electricity have 100 percent regional content.

2. Assuming material and supplies have 50 percent regional content.

TABLE 4.22 REGIONAL CONTENT OF TOTAL OIL REFINING EXPENDITURES

(MILLIONS OF DOLLARS)

Year	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
OPERATIONS													
(1) Expenditures[1]	102.31	112.42	116.39	122.68	127.55	137.74	142.38	166.46	194.67	253.68	431.77	639.86	959.79
(2) Regional Contend of Operating Expenditures,[2]	55.56	60.77	63.07	66.34	69.00	74.35	77.07	90.17	104.81	135.82	228.83	332.72	503.21
INVESTMENTS													
(3) Expenditures[3]	6.01	6.35	3.86	10.22	4.34	2.78	3.23	3.16	4.14	5.51	5.13	13.33	13.02
(4) Regional Content of Operating Expenditures[4]	3.00	3.17	1.93	5.11	2.17	1.39	1.61	1.58	2.07	2.75	2.56	6.66	6.51
(5) Total Regional Content = (2) + (4)	58.56	63.94	65.00	71.45	71.17	75.74	78.68	91.75	106.88	138.57	231.39	339.38	509.72

1. Values from Table 4.24 row (4); Values for 1976 are not available at this time and have been extrapolated from last year's expenditures.
2. Regional contents in percent are computed in Table 4.25; Regional content for 1976 is assumed to be 52.43 percent same as 1975 values.
3. Construction in Canada, Statisitcs Canada, Catalogue #64-201, Annual (e.g., item 77, table 26 in 1974-76 publication). This includes related structures employed in production of petrochemicals (see footnote page 40 in 1968-70 issue).
4. Regional content @ 50%.

TABLE 4.23 BREAKDOWN OF EXPENDITURES OF PETROCHEMICAL INDUSTRY (MILLIONS OF DOLLARS)

Year	1973	1974
(1) Salaries & wages (1973 values note 1 and 1974 value see note 2)	37.66	43.54
(2) Cost of fuel and electricity (1973 values see note 1 and 1974 values see note 2)	16.98	12.49
(3) Cost of material and supplies (1973 values see note 1 and 1974 values see note 2)	100.33	129.19
(4) Total expenditures	154.97	129.19
(5) Salaries and wages as a percent of total (assuming 100 percent regional content)	24.30	23.50
(6) Cost of fuel and electricity as a percent of total (assuming 100 percent regional content)	10.96	6.74
(7) Material and supplies as a percent of total	64.74	69.76
(8) Regional content of material and supplies in percent @ 50%	32.37	34.88
(9) Total regional content = (5) + (6) + (8)	67.63	65.12

1. Alberta Statistical Review, Annual 1975, Alberta Treasury, Bureau of Statistics, Table 64, Page 80.

2. Principal Manufacturing Statistics, Alberta, 1974, Alberta Treasury Bureau of Statistics, Table 11, Page 70.

TABLE 4.24 REGIONAL CONTENT OF PETROCHEMICAL INDUSTRY EXPENDITURES[1]
(MILLIONS OF DOLLARS)

Year	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Total Value of Production,[2]	72.0	91.28	106.50	114.90	113.00	110.8	108.1	124.5	134	247.53	287.9	277.91	271.95
Total Expenditures[3]	45.36	57.50	67.09	72.38	71.19	69.8	68.10	78.43	84.42	154.97	185.22	175.08	171.32
Regional Content of Expenditures,[4]	29.93	37.95	44.28	47.77	46.98	46.07	44.94	51.76	55.71	102.28	122.24	115.55	113.07

1. These are operational expenditures only. Capital expenditures on petrochemical are included in oil refining investment expenditures. No separate investment expenditures for petrochemical is available.

2. Alberta Statistical Review (formerly Review of Business Conditions - Alberta), Annual, Alberta Bureau of Statistics.

3. For years 1964 through 1972 and 1975 and 1976 no expenditure information is available. However, examination of 1973 and 1974 data indicates that total expenditures on operations are about 63 percent of the value of production, e.g., for 1973 total expenditures are 154.97 million dollars and value of production are 247.53 million dollars and for 1976, total expenditures are 185.22 million dollars and value of productions are 287.9 million dollars. Therefore, total values of production are multiplied by 0.63 to get total expenditures for years 1964 through 1972 and 1975 and 1976.

4. Regional contents for 1973 and 1974 are computed in Table 4.23. In absence of this information for other years intermediate value of 66 percent regional content will be assumed for all years 1964 through 1976.

4.6 Expenditures on Alberta Oil Sands (Tar Sands)

Expenditure information on Alberta Oil Sands is available only on a cummulative basis for the period 1947 to 1976 and is given in Table 4.25. In order to estimate the annual expenditures of tar-sand operations of the petroleum industry, it has been assumed that these expenditures are proportional to the amount of synthetic crude oil produced each year from oil sands. The production values of synthetic oil are given in Table 4.26 (9). Since breakdown of these expenditures into salaries and wages, materials and supplies, contractor and service payments, and construction and machinery is not available, it is assumed that the weighted averages of regional contents for operating and capital expenditures for petroleum industry, estimated earlier, are also applicable for expenditures on tar-sand. The estimates of regional content of expenditures on Alberta Oil Sands are presented in Table 4.26.

4.7 Total Income Contribution of Petroleum Industry

In previous sections the regional contents of operating, capital, transportation, oil refining, petrochemical and Alberta Oil Sands expenditures, (sE), have been estimated for the period 1964 to 1976. A summary of these regional content estimates are presented in Table 4.27. The multiplier values $1/1-pk$, is 2.13. The total income contribution of petroleum industry to Alberta economy, $Y=sE/(1-pk)$, is then computed. It is presented in row (9) of Table 4.27. Finally, the estimates of income contributions of the petroleum industry as a percent of Alberta's Gross Domestic Product are made. These estimates are shown on row (11) of Table 4.27. As is evident from this table, up to 1973 the ratio of dollar income contributions of the petroleum industry to gross provincial domestic product varied around 33 percent. In 1974, it increased to 37 percent, in 1975 it increased to 39 percent and in 1976 to 47 percent. The reasons for the increases in the ratios will be discussed in the following Chapter V.

TABLE 4.25 NET CASH EXPENDITURES OF THE PETROLEUM INDUSTRY ON ALBERTA OIL SANDS EXPLORATION AND DEVELOPMENT

(MILLIONS OF DOLLARS)

	Cummulative 1947-76,[1]	Percent of Total
CAPITAL EXPENDITURES		
Including exploratory & delineating drilling, research and development, fixed installations, machinery & equipment, housing, pollution control equipment, etc.	1,736.0	72.49
OPERATING COSTS		
Including taxes, royalties, administration expenses, land acquisition & retention costs, reclamation costs, other operating costs, etc.	658.7	27.51
TOTAL	2,394.7	100

1. Canadian Petroleum Association, Statistical Handbook, 1976, Section IV, Table 20. Yearly break-up is not available.

TABLE 4.26 REGIONAL CONTENT OF EXPENDITURES ON ALBERTA OIL SANDS (MILLIONS OF DOLLARS)

Year	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	Total Cumulative
(1) Alberta Synthetic Crude Oil Production, Million Barrels,[1]	0.45	5.18	10.09	12.08	15.58	18.82	18.45	16.88	15.76	17.68	130.97
(2) Alberta Synthetic Crude Oil Production as a Percent of Total	0.34	3.95	7.70	9.23	11.89	14.38	14.09	12.89	12.03	13.49	100
(3) Capital Expenditures[2]	5.90	67.7	133.67	160.23	206.41	249.64	244.60	223.77	208.85	234.19	-
(4) Regional Content of Capital Expenditures[3]	3.89	45.36	89.56	99.34	125.91	157.27	156.55	140.98	131.57	147.54	-
(5) Operational Expenditures[2]	2.24	25.99	50.67	60.73	78.24	94.62	92.71	84.82	79.16	88.76	-
(6) Regional Content of Operational Expenditures[4]	1.76	20.01	37.99	46.16	60.24	71.91	72.32	69.55	65.70	73.67	-
(7) Total Regional Content = (4) + (6)	5.65	65.37	127.55	145.50	186.15	229.18	228.87	210.53	197.27	221.21	-

1. Canadian Petroleum Association, Statistical Handbook, 1976, Section III, Table 2; Alberta Statistical Review, Annual, 1975, Table 40.

2. Value from Table 4.25 is multiplied by values in row (2) above to get these expenditures.

3. Regional content ($\bar{s}_c$) given in Table 4.16 are assumed to be applicable here.

4. Regional content ($\bar{s}_o$) given in Table 4.8 are assumed to applicable here.

TABLE 4.27 TOTAL INCOME CONTRIBUTION OF PETROLEUM INDUSTRY
(MILLIONS OF DOLLARS)

Year	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
(1) Regional Content of Operating Expenditures	231.62	264.61	299.12	352.78	400.88	411.48	454.86	527.34	553.29	778.67	1,506.62	1,960.57	2,768.47
(2) Regional Content of Capital Expenditures	217.21	261.88	249.48	269.98	286.07	308.63	270.89	295.19	315.36	360.03	435.04	530.00	794.47
(3) Regional Content of Transportation Expenditures	32.75	30.66	26.80	35.28	47.71	61.69	73.41	53.61	61.14	64.76	70.89	62.06	75.66
(4) Regional Content of Oil Refining Expenditures	58.56	63.94	65.00	71.45	71.17	75.74	78.68	91.75	106.88	138.57	231.39	339.38	509.72
(5) Regional Content of Petrochemical Industry	29.93	37.95	44.28	47.77	46.98	46.07	44.94	51.76	55.71	102.28	122.24	115.55	113.07
(6) Regional Content of Alberta Oil Sand Expenditures	-	-	-	5.65	65.37	127.55	145.50	186.15	229.18	228.87	210.53	197.27	221.21
(7) Total Regional Content	570.07	659.04	684.68	782.91	918.18	1,031.16	1,068.28	1,205.8	1,321.56	1,673.18	2,576.71	3,204.83	4,482.6
(8) Multiplier	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13
(9) Total Income Contribution = (7) (8)	1214	1404	1458	1668	1955	2196	2275	2568	2815	3563	5488	6826	9548

TABLE 4.27 TOTAL INCOME CONTRIBUTION OF PETROLEUM INDUSTRY
(MILLIONS OF DOLLARS)
(CONTINUED)

	Year	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
(10)	Alberta's Gross Domestic Product,[1]	3,899	4,297	4,875	5,239	5,767	6,366	6,950	7,713	8,670	10,871	14,950	17,528	20,407
(11)	Income Contribution as a Percent of Alberta GDP	31	33	30	32	34	34	33	33	32	33	37	39	47

1. Alberta Economic Accounts, 1976, Table 2, Alberta Treasury, Bureau of Statistics.

CHAPTER V

PUBLIC POLICY IMPLICATIONS

As mentioned earlier, total income contributions of the petroleum industry have been fluctuating around 33 percent of Alberta's Gross Domestic Product during the period 1964 to 1973. This contribution increased to 37 percent in 1974, 39 percent in 1975 and 47 percent in 1976. Although income contribution of the petroleum industry to Alberta has been substantial, there have been extensive leakages since petro-dollars were not effectively recycled in the Alberta economy. In this Chapter, first the public policy problems arising out of leakages from the expenditures will be discussed. Following this, solutions of the problem will be suggested.

5.1 Public Policy Problems

As discussed in Chapter III, the total income contribution of petroleum industry can be expressed by $Y=sE/(1-pk)$. In this expression, E represents the total expenditures of the petroleum industry $(s/(1-pk))$ is the multiplier. Expenditures are equal to sales minus the profits. Sales, in turn, depend upon the volume and price of crude petroleum and its by-products. The multiplier, on the other hand, reflects on the leakages that take place before and after the petroleum industry expenditures have accrued as income in the province. Thus the total income contribution of petroleum industry depends upon (i) the volume and price of crude petroleum and its by-products and (ii) the leakages. In this section, policy problems related to these two factors will be discussed.

5.1.1 Volume and price of crude petroleum and its products

As mentioned above, the total income contributions of the petroleum industry depend upon the volume of crude petroleum and its products, and their prices. Ordinarily, an increase in either volume or prices would increase the income contributions of the petroleum industry to the province. However, during the period 1964 through 1972, the industry faced a buyer's market. This limited its capacity to increase the volume and the price. An examination of Tables 5.1 and 5.2 shows this tread. Information summarized in these tables indicates that the production increased moderately from 1964 through 1971 but the prices of crude oil and natural gas virtually remained unchanged during this period. It took seven years, from 1964 to 1971, for the industry to double its production at the same sale prices. Since the year 1972 onwards, except for the year 1973, the price of crude oil and natural gas increased substantially but their volume of production did not increase. Crude oil prices increased by 202 percent and natural gas prices increased by 450 percent in a period of four years, from 1972 to 1976 (Table 5.2). It appears that the increase in the contributions of petroleum industry to Alberta economy in 1974, 1975 and 1976, are due to price increases of crude oil and gas.

The petroleum industry provides a major portion of the Alberta government revenues through its payments in taxes, royalties, leases and rentals. These payments are like leakages as far as the income effect of the petroleum industry's expenditures are concerned. However, these payments also increase public expenditures and income in Alberta. Provincial revenues collected from petroleum industry from 1964 to 1976 are presented in Table 5.3. As discussed in Section 2.4.5, a portion of the increased price of oil is returned to Alberta government by the industry as per incremental royalty schedule introduced in 1974 by the provincial government. Revenues presented in Table 5.3 also include

TABLE 5.1 CRUDE OIL AND NATURAL GAS PRODUCTION IN ALBERTA

	Year	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
(1)	Crude Oil in Millions of Barrels,[1]	175.37	183.74	202.5	230.80	251.54	279.29	325.62	355.32	424.44	522.17	497.63	424.64	383.01
(2)	Natural Gas in Billions of Mcf[2]	0.98	1.08	1.15	1.25	1.44	1.68	1.93	2.12	2.42	2.62	2.63	2.66	2.66

1. Canadian Petroleum Association, Statistical Handbook, 1976, Section III, Table 1.

2. Canadian Petroleum Association, Statistical Handbook, 1976, Section III, Table 9.

TABLE 5.2 AVERAGE PRICES OF CRUDE OIL AND NATURAL GAS FOR WESTERN CANADA[1]

	Year	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
(1)	Well Head Oil Price in Dollars per Barrel,[2]	2.45	2.41	2.39	2.38	2.40	2.42	2.49	2.75	2.77	3.41	5.72	7.18	8.38
(2)	Percent increase of Oil Price from 1972	-	-	-	-	-	-	-	-	0	23	106	159	202
(3)	Well Head/ Plant Gate Oil Price ¢/Thousand Cubic Feet[2]	13.9	13.7	14.4	14.8	14.8	14.7	15.2	15.0	15.8	17.4	27.4	55.7	86.9
(4)	Percent increase of Gas Price from 1972	-	-	-	-	-	-	-	-	0	10	73	252	450

1. This includes Alberta, British Columbia, Manitoba, Saskatchewan and Territories.

2. Canadian Petroleum Association, Statistical Handbook, 1976, Section VI, Table 1.

TABLE 5.3 PROVINCIAL OIL REVENUES (MILLIONS OF DOLLARS)[1]

Year	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Land Sales[2,3]	84.82	119.66	99.12	87.72	93.39	102.18	25.69	23.92	25.73	43.59	58.25	105.99	160.15
Rentals[2,3]	42.77	57.41	53.22	53.51	55.23	61.22	56.11	68.84	75.19	80.56	76.29	100.65	55.65
Royalties[2,3]	60.85	67.97	75.26	92.71	101.32	113.22	136.42	167.72	196.28	392.64	964.08	1,352.77	1,762.71
Total	188.44	245.04	227.60	233.94	249.94	276.62	218.22	260.48	297.20	516.79	1,098.62	1,559.41	1,978.51
Percent Increase from 1972	-	-	-	-	-	-	-	-	0	74	270	425	566

1. This includes petroleum and natural gas.
2. Oilweek, February 13, 1978, page 50.
3. Alberta Statistical Review, Alberta Treasury, Bureau of Statistics, Table 55.

these incremental royalty payments. According to the data presented in this table, the government revenues increased by 566 percent from 1972 to 1976 while this increase was only 60 percent in the preceeding period from 1964 to 1972.

It, thus, appears that increases in income contributions of petroleum industry as a percent of Alberta Gross Domestic Product, shown in Table 4.27, are mainly due to price increases. Therefore, the policy of raising domestic oil and gas prices to international market price level should be continued. This policy will bring higher revenues to the province and at the same time will encourage development of oil-sands that are uneconomical at the present domestic prices. The higher prices and the greater volumes produced from oil-sands will ensure higher income to the province. Increasing domestic oil and gas prices to international price level are, however, inflationary. On the other hand, if these prices are not increased they will reduce provincial revenue. The argument for keeping the oil and gas prices at international level has two objectives: firstly to conserve the resources and secondly to increase the production.

5.1.2 Leakages

There are two types of leakages. The first type of leakage takes place in the first round of expenditures and consists of remittances from wages and salaries abroad, import of capital inputs, and interests, dividends and service payments to non-residents. The second type includes import of consumer goods and savings and it takes place after the expenditures have accrued as income to the factor owners resident in Alberta. They occur in the second and following rounds of expenditures.

(a) First round leakages

As noted above, these leakages take place in the first round of expenditures and from the income generation point of view they reduce the size of expenditures themselves. In income contribution equation (3.10), these leakages are lumped in the term sE. Actually, the first round of leakages are (1-s)E. A smaller s value means higher first round leakages and low income contributions. To the extent these expenditures leak out, income contributions to the province is reduced. Table 4.16 presents the weighted average values of the regional contents of capital expenditures for different years. These values varied from 0.61 to 0.68 between 1964 and 1976. This implies that Alberta's reliance for imports of capital inputs has not decreased since 1964 and 30 to 40 percent of capital expenditures leak out of the province.

As discussed in Chapter IV, most of the petroleum industry employees are resident in Alberta and spend most of their income locally. Therefore, wages and salaries will have a high regional content. On the contrary, a major portion of total capital goods used in Alberta is imported as they are not produced locally. The annual dollar value of different capital goods imported by the petroleum industry in Alberta and cleared at Alberta custom points is shown in Table 5.4. It was not possible to determine what proportion of trucks, construction equipment, etc. imported into the province was intended for the petroleum industry. Therefore, the values of imports of these items were excluded from these figures. Further, capital goods imported by the petroleum industry in Alberta could have been received at points outside Alberta as well. Therefore, the figures for imports of capital goods in Alberta presented in Table 5.4 are an underestimate. The import values of capital goods for Alberta indicate that (i) it forms a significant portion of total import in Canada, implication being that Alberta has been the center of petroleum activities and (ii) the leakages through the petroleum industry's imports of capital goods have been extensive, continued over the full life span of this study, and reduced the income contribution of the expenditures of the petroleum industry.

TABLE 5.4 ANNUAL CURRENT DOLLAR VALUE OF IMPORTED CAPITAL GOODS OF THE PETROLEUM INDUSTRY (MILLIONS OF DOLLARS)[1]

Year	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Imports of capital goods cleared at Alberta check points[2]	28.49	25.07	31.09	42.44	51.42	-	-	-	-	-	-
Total imports of capital goods by Petroleum Industry in Canada[3]	41.37	36.74	43.99	54.45	77.25	63.96	89.77	104.29	113.65	142.11	193.68

1. Imports of capital goods include:

   (a) petrol and gas field production equipment
   (b) rock drill bits, rotary type
   (c) well drilling machinery
   (d) rock drills and parts

2. DBS, Customs - Clearance - Imports, 1966-70.

3. Statistics Canada, Monthly Imports by Commodities, Catalogue #65-007, cumulative values for the year are given in December issue (e.g., page 161-162 in 1972 issue).

4. All the information is not available.

From operating expenditures, dividend, interest and service payments to non-residents caused heavy leakages. Non-resident ownership and control of the petroleum industry were important reasons for these leakages. As is evident from Table 5.5, non-resident ownership and control of the petroleum industry is the highest among all the major industries in Canada. The extent of non-resident ownership and control of petroleum industry is likely to be worse in Alberta, than in Canada because even the Canadian capital invested in the petroleum industry in Alberta has come largely from outside the province. As the non-resident ownership and control did not decrease over the years, leakages through dividends, interest and service payments have continued abated. Figures given in Table 5.6 give some idea about the extent of such leakages. These data show that such payments to non-residents have been increasing over the years indicating that leakages have been growing. The data for non-Albertan Canadian ownership of petroleum industry is not available. However, it is logical to assume that most of dividend, interest and service payments either accrued to non-residents or non-Albertan Canadian residents and constituted a leakage to Alberta.

Thus, leakages through imports of capital inputs, and dividend, interest and service payments to non-residents have important policy implications. Although these leakages have important policy implications it is not easy to find solutions to plug them. One of the important reasons for this problem is that the creation of a capital goods industry in any area requires many inputs which may not be available in a short period.

(b) Second and subsequent rounds of leakages

Second type of leakages include import of consumer goods and savings. These leakages affect the multiplier size, $(1/(1-pk))$, through the denominator of the multiplier equation. They take place after the expenditures have accrued as income to the factor owners resident in

TABLE 5.5 PERCENTAGE OF NON-RESIDENT OWNERSHIP IN SELECTED INDUSTRIES (PERCENT OF FOREIGN CONTROL)

	MAJOR INDUSTRY	ASSETS			SALES		
		1968	1974	1975	1968	1974	1975
1	Tobacco Products	84	100	100	100	100	100
2	Petroleum & Coal Products	100	93	92	99	96	96
3	Rubber Products	93	93	93	91	90	90
4	Transport Equipment	87	79	78	90	89	88
5	Machinery	72	68	67	73	82	83
6	Chemicals & Chemical Products	82	77	75	81	69	68
7	Electrical - Products	64	65	66	63	65	66
8	Non-Metallic Mineral Products	52	67	66	42	57	56
9	Miscellaneous Manufacturing	54	49	50	51	49	49
10	Primary Metals	55	15	14	51	18	17
11	Textile Industries	40	61	59	29	57	57
12	Metal Fabricating	47	42	43	45	43	43
13	Paper & Allied Products	39	41	41	41	42	44
14	Food	31	49	50	27	39	41
15	Beverage		30	30		35	35
16	Wood	30	28	29	16	22	20
17	Leather Products	22	23	23	21	22	21
18	Printing, Publishing & Allied	21	12	12	14	11	12
19	Furniture	19	18	23	16	16	16

1968 Data are Taken From: Gray, H.: Foreign Direct Investment in Canada, Government of Canada, Catalogue No. CP 32-15/1971, Information Canada, page 21.

1974 and 1975 Data are Taken From: Corporations and Labor Unions Returns Act, Statistics Canada, Catalogue 61-210, Annual, Statement 26.

TABLE 5.6 PAYMENTS TO NON-RESIDENTS BY PETROLEUM FIRMS[1]
(MILLIONS OF DOLLARS)

Year	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
Dividends:												
U.S.	65	68	73	78	-	-	84	94	100	126.9	131.9	142.7
Total[3]	96	107	120	131	-	-	91	101	108	135	141.5	154.5
Interests:												
U.S.	-	-	-	-	-	-	18	17	12	8.1	16.9	6.4
Total[3]	-	-	-	-	-	-	26	28	23	18.1	34.7	23.1
Business Service Payments:												
U.S.	-	-	-	-	-	-	19.6	25.3	31.6	32.1	55.5	61.6
Total[3]	-	-	-	-	-	-	47.3	74.3	56.1	52.9	78.4	95.4

1. All the figures are not available.

   1964-1967 Data are From: Department of Trade, Industry and Commerce, Government of Canada, Foreign-Owned Subsidiaries in Canada, 1964-67, Queen's Printer, Ottawa, 1970, pages 79-80.

   1970-1975 Data are From: Statistics Canada, Report Under Corporations and Labor Unions Return Act, Catalogue #61-210 for 1970, p. 226; 1972, pp. 280-282; 1973, p. 27; also 1973 and 1974, p. 250; and for 1975, p. 262.

2. Figures for 1964-67 pertain to petroleum, coal products and mineral fuel.

3. Total includes payments to the Canadian residents as well as non-residents.

Alberta and occur in the second and following rounds of expenditures. These leakages have two components (i) leakages through import of consumer goods denoted by (1-p), and (ii) leakages through savings denoted by (1-k).

Marginal propensity to consume, k, for Alberta has been estimated 0.84 in Chapter III. When this value is compared with k values for other provinces, presented in Table 3.1, it is evident that there are more leakages through savings, represented by (1-k), in Alberta than British Columbia, Ontario and even Canada on the whole. However, as long as these savings are locally invested it is good for the Alberta economy. When this value of k is combined with the values of p, the computed value of multiplier, (1/(1-pk)), is 2.13. This means that rapid economic growth in Alberta is accompanied with a low multiplier value. Retention of expenditures, which is reflected in the size of the multiplier, is as important for an economy as are expenditures themselves. Capacity to retain expenditures is a good indication of the level of economic development of a region. From this aspect Alberta appears to be a poorly developed region since the multiplier value has been low.

Thus leakages through imports of consumer goods have significant public policy implications.

5.2 Public Policy Implications

5.2.1 First round leakages

As discussed in Section 5.1.2, the first round leakages, such as, import of capital goods, and dividend, interest and service payments to non-residents, reduce income contribution of expenditures of petroleum industry. In order to reduce these leakages, public policy should be directed towards diversification of the Alberta economy in the area of capital goods where (a) it has comparative cost advantage and (b) ownership of the resident Albertans of big businesses located in Alberta.

The obvious solution to plug these leakages created by the import of such capital inputs as the drill rigs, drill bits, steel pipes, structural steel, machinery, trucks, etc., is to manufacture them in Alberta. However, manufacturing these goods in Alberta is difficult to achieve. Small size of Alberta market, use of sophisticiated technology, significance of economies of scale and heavy capital and labor requirements are some of the major factors against diversification of Alberta economy into these industries (13).

In order to reduce the leakages created by dividend, interest and service payments to non-residents, public policy needs to be formulated such that (a) preference is given to Albertans in new issues of equity and debt, (b) for this purpose, government may provide loans to individuals from Alberta Heritage fund and (c) Alberta Heritage fund may directly be invested by the Alberta government within the province. Alberta government has already committed a part of its Heritage Savings and Trust Fund in the financing of Alberta Energy Company and Alberta Gas Trunk Line Co. Continuation of such a policy will reduce future dividend and interest payments to non-residents.

A survey conducted in Calgary shows a rapid growth of ancilliary service industry in Alberta (42). The survey estimates that the ratio of oil and gas exploration, development and producing companies located in Calgary to that of in Canada is 79 percent. The percentages for these firms are given in Table 5.7 below.

TABLE 5.7 RATIO OF FIRMS IN CALGARY TO THAT IN CANADA[1]

Firms	Ratio in Percent
Consulting Firms	72
Geophysical Contracting Firms	68
Oil Well Servicing Firms	30
Data Processing Firms	88
Refining, Marketing, Processing and Plant Operating Firms	57

If the number of such firms located in Edmonton and other Alberta cities are added to the figures in Calgary, Alberta has developed a sizeable petroleum service industry. This has helped reduce the leakages through service payments to non-residents. As discussed earlier, service payments to non-residents have been increasing over time. In the absence of these firms such payments to non-residents would have been a lot more. This industry should, therefore, be further expanded so that service payments are reduced to a minimal.

5.2.2 Second and subsequent round of leakages

As discussed in Section 5.1.2, there are significant leakages through the imports of consumer goods. These leakages reduce the income effects of the petroleum industry expenditures through the reduction of the multiplier. As shown in Table 5.8, a considerable amount of total gross domestic expenditures in Alberta are incurred on consumer goods. However, only a limited number of such goods are produced locally. This is shown by the fact that manufacturing industry contributes only about nine percent of Alberta's Gross Domestic Product, (Table 5.8). These expenditures, therefore, leak out of the province. The obvious solution for reducing these leakages appears to be in diversifying Alberta economy in consumer goods sector.

Considerable amount of diversification of the Alberta economy into consumer goods sector appears feasible. Any discussion on diversification must be viewed from the comparative cost advantages of their manufacturing in Alberta. This, in turn, depends on a wide range of factors such as, technology, size of the market, transportation costs, raw material, etc. A detailed discussion of these factors is beyond the scope of this study. However, they are briefly discussed below. The diversification program can be related to the three groups of consumer goods.

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1. Hull, K., "Records Tumble Again in Stampede City", Trade and Commerce, October 1973, p. 76.

TABLE 5.8 EXPENDITURES ON CONSUMER GOODS AND SERVICES AND MANUFACTURING AS A PERCENT OF ALBERTA'S GROSS DOMESTIC PRODUCT

	Year	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
(1)	Expenditures on Goods and Services, Million Dollars,[1]	2,296	2,462	2,724	2,984	3,302	3,669	3,883	4,249	4,722	5,356	6,369	7,725	8,983
(2)	Alberta's GDP, Million Dollars,[2]	3,894	4,297	4,875	5,239	5,767	6,366	6,950	7,713	8,670	10,871	14,950	17,528	20,407
(3)	Consumer Expenditure as a Percent of GDP $(= \frac{(1)}{(2)})$	59	57	56	57	57	58	56	55	54	49	43	44	44
(4)	Manufacturing as a Percent of GDP,[3]	-	-	-	-	-	-	-	9.4	9.8	9.5	9.0	-	-

1. Alberta Economic Accounts, Bureau of Statistics, Alberta Treasury, 1976, Table 8.

2. Alberta Economic Accounts, Bureau of Statistics, Alberta Treasury, 1976, Table 2.

3. Principle Manufacturing Statistics, Alberta, Bureau of Statistics, Alberta Treasury, 1974, Table III. (Data for all the years are not available). This includes industry groups, e. g., food and beverages, wood, petroleum and coal, metal fabricating, chemicals, transportation equipment, etc.

(i) Non-durable goods sector,

(ii) Service industry of consumer goods sector, and

(iii) Semi-durable and durable goods sector.

The non-durable goods and service industry of consumer goods sector appears most relevant for the immediate diversification of the Alberta economy. Scale of production and non-availability of capital in the past restricted the development of breakfast cereals, confectionaries, most of textiles, hardware, major and small electrical applicances, soap and cleaning compounds industries in Alberta[1]. To a certain extent, weight and volume of non-durable goods shelter this industry from competition from the industries located in other parts of the country because of transportation cost. Use of simple technology and little significance of economies of scale, make the small scale production of these products feasible for limited Alberta market (42).

Diversification of Alberta's economy into semi-durable and durable consumer goods is more difficult to achieve. Small size of the Alberta market, use of sophisticated technology, significance of the economies of scale, lack of managerial and entrepreneurial factors, and heavy capital and labour requirements are some of the major factors against diversification of Alberta's economy into these industries (13, 42). A careful search is needed to identify the industries in this group that have the comparative cost advantage. A few of such industries have already been identified and a list of these is presented in Appendix III. For an effective diversification program these industries can be divided into two categories:

(i) industries with qualified growth prospects, and

(ii) industries with assured growth prospects.

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1. Cotton and jute bags, store products, mineral wools, and venetian blind industries face declining demand. Flour mills have reached a plateau. A complete list of such industries is available on page 208 and 209 of Opportunities for Manufacturing: Prairie Regions to 1981 (25).

The diversification program in both the categories need to be considered for the long term perspective. Industries with qualified growth prospect face major problems and therefore, can only grow in the presence of a set of public policies designed to overcome their problems. These policies may include fiscal incentives, subsidization of public and private research efforts for developing new products and methods of productions and changes in the distributions of inter-regional disadvantages that have worked against Alberta (42). The industries with growth prospects are divided into three subgroups: (a) Industries with moderate growth prospects (b) Industries with good growth prospects, and (c) Industries with major growth prospects. Public policy should be directed so that their comparative cost advantages and growth potentials are retained and if possible, further encouraged.

Petrochemical industry development in Alberta is an important area that needs to be considered for diversification. Development of a viable petrochemical industry in Alberta has been difficult for several reasons. Firstly, the capital cost of such a project is high. Secondly, the industry uses a highly developed technology. Finally, Canadian Petrochemical industry has historically been characterized by small-scale facilities aimed at a restricted domestic market. However, in terms of supply of feedstock to the industry, Alberta is one of the industrial world's most favoured areas.

According to Dr. John Sutherland, senior vice-president of Alberta Gas Ethylene Company, the most important piece of the petrochemical puzzle is that of markets[1]. Majority of the market, where Alberta-produced petrochemicals can expect to be competitive, lies in

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1. By itself, Alberta represents a small and inadequate market and is geographically distant from the rest of the Canadian market, most of which is in Ontario and Quebec. The most geographically accessible market is located to the south where in the Western U.S., a market exists which is almost 50 percent greater than the total Canadian market and which is generally not supplied by local production (19).

the United States. Therefore, the petrochemical industry in Alberta must look towards this market and the range of products must be appropriate accordingly. In addition, in order to improve competitiveness the province should continue building world-scale plants so that the unit costs are reduced.

Petrochemical products with most potential for local manufacturing are those with the highest per capita consumption. These products are relatively unsophisticated and got into consumer's hands in as few steps as possible: as an example, garbage and shopping bags, water pipes, conduits, gas pipes, bottles and food containers (19).

The development policy of petrochemical industry is also supported by a federal task force[1] report released in July, 1978. The report concluded that replacing imports with domestic products offers enormous potential for Canada's petrochemical industry. It recommended that the government introduce tariffs and provide greater protection to products such as rubber, plastics, synthetic fibres, textiles, clothing, paint and varnish. The task force also recommended that Ottawa negotiate a bilateral free trade agreement with the U. S. for some certain petrochemical products in which some Canadian producers could be competitive. This could be done by using the export of additional quantities of natural gas as a bargaining leverage. It also noted that the Canadian Petrochemical industry, particularly that of Alberta, could soon come on stream and could compete on a global scale (38).

Thus, a significant amount of diversification of Alberta's economy in the consumer goods sector appears feasible. This will replace imports with domestic products and reduce leakages.

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1. This task force consisted of 17-member group of industry, government, labor and academic representatives. Among companies represented on the task force were Canadian Industries Ltd., Dow Chemicals of Canada Lat., Alberta Gas Ethylene Ltd., Gulf Oil Canada Ltd., Celanese Canada Ltd. and Imperial Oil Ltd.

5.2.3 Specialization in petroleum related technology

Payments to non-residents for the use of their technology is an important source of leakage. The solution to this leakage is to develop ones own technology. As revenues from the sales of oil and gas increase, Alberta can commit a part of this revenue for the development of technology. As an example, the provincial government has already initiated such a program in the area of oil-sands development. This was done in 1974 by establishing the Alberta Oil Sands Technology and Research Authority, AOSTRA. It was initially funded with 100 million dollars from general provincial revenue. Subsequently, another 44 million dollars were provided from the Heritage Savings and Trust Fund. Presently, AOSTRA has a joint venture with the industry in this research program. Appendix IV provides summary information of the joint AOSTRA-Industry research projects. AOSTRA retains title to all new patents and technology, and shares licensing income in proportion to its financial contribution, which may result from the joint project. Success in this field will increase export from sale of oil sand technology, materials, equipment and services offshore to the countries that have similar deposits, e.g., Venezuela, Madagascar and other countries.

Another area of technological specialization that will reduce leakages and encourage foreign trade by export of technology is in oil and gas exploration and development. To a degree the trend in such an export has already been established in Alberta in the past few years. This is shown by the information summarized in Appendix V. This appendix contains a list of Alberta-based petroleum firms, their degree of foreign ownership and their exploration activities outside Alberta.

This government-industry policy of attaining technological specialization and out-of-province exploration and development activities of the petroleum firms should be encouraged by pertinent government policies. This can be done by committing more capital on such research and development programs inside the province and encouraging petroleum firms to bid on jobs outside the province. This will ensure present and future income to the province by the export trade from the sale of technology, materials, equipment and services outside the province.

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APPENDIX I

CONSUMER EXPENDITURE ON GOODS AND SERVICES AND PERSONAL DISPOSABLE INCOME[1]

Year	Consumer Expenditure on Goods and Services (C)	Personal Disposable Income (Y)
	Millions of Dollars	
1961	1,931	1,999
1962	2,069	2,194
1963	2,166	2,307
1964	2,296	2,394
1965	2,462	2,653
1966	2,724	2,995
1967	2,984	3,181
1968	3,302	3,528
1969	3,669	3,848
1970	3,883	4,057
1971	4,249	4,524
1972	4,722	5,140
1973	5,356	6,108
1974	6,369	7,192
1975	7,725	8,841
1976	8,983	10,313

1. Alberta Economic Accounts, Bureau of Statistics, Alberta Treasury, 1976, Table 8.

APPENDIX II

ESTIMATION OF REGIONAL CONTENT OF CONSUMER SPENDING ON GOODS AND SERVICES (p)

This appendix describes two procedures for estimating the regional content of consumer expenditures in Alberta. Both of these procedures yield values of p which are fairly close.

Procedure 1

This procedure was originally used by Singh (42) in estimating the regional content of consumer spending on goods and services. In this mathod, following assumptions were made to overcome the gaps in data.

(1) All services were locally provided.

(2) Ratio of goods and services in consumer expenditures for Canada is also true for Alberta.

(3) Distribution of imported goods and services among the provinces in Canada was identical to the distribution of personal income among the provinces.

Figures used below are in millions of dollars unless otherwise stated and belong to 1967. Statistics Canada estimated the interprovincial shipments of manufactured goods for 1967. However, similar information is not available for other years. Also, the estimates of interprovincial shipments for 1967 did not include non-manufactured goods.

1.	Total import of goods and services in Canada[1]	14,663
2.	Total import of goods (14,663) (.606)	8,886
3.	Alberta personal income as a percentage of Canada[2]	0.073
4.	Alberta share of imported goods @ 0.073	649
5.	Imports of goods from other provinces of Canada[3]	522
6.	Total value of goods imported into Alberta (4+5)	1,171
7.	Total personal expenditures on goods and services for Alberta[4]	2,993
8.	Total personal expenditure on goods for Alberta @ 60.6% (2,993) (0.606)	1,814
9.	Imports of goods as a ratio of total consumer expenditures on goods (6÷8)	0.65
10.	Regional content of goods produced (1-0.65)	0.35
11.	Regional content of services @ 100% (1) (0.394)	0.394
12.	Regional content of goods @ 35% (0.35) (0.606)	0.21
13.	Weighted average of regional content of goods and services in Alberta (11+12)	0.61

Procedure 2

This procedure is based on the value of manufacturer's factory shipments by industrial groups for Alberta. In order to compare the value of p estimated in Procedure 1, only 1967 data has been used. In this method, following assumptions were made to overcome the gaps in data.

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1. Statistics Canada, National Income and Expenditure Account, Historical Revision, 1926-1971.
2. Turner, John, Economic Review, Information Canada, Catalogue No. F2-3573, 1973, p. 90.
3. Statistics Canada, Destination of Shipments of Manufacturers, 1967, Catalogue No. 31-504.
4. Alberta Bureau of Statistics, Alberta Economic Accounts, 1947-1974, p. 32.

(1) All services were locally provided.

(2) Since the production of consumer goods in Alberta were significantly less than the value of locally consumed goods, it was therefore assumed that all of the locally produced goods were consumed in Alberta.

Figures used below are in millions of dollars unless otherwise stated and belong to 1967.

(1)	Value of factory shipment of non-durable goods (Food and Beverages)[5]	635
(2)	Value of factory shipment of semi-durable goods (Textile (12), Leather (2), Furniture and Fixtures (17), Rubber and Plastic Products (0), Printing and Publishing (19))[5]	50
(3)	Value of factory shipment of durable goods (Electric Products (20), Petroleum Products (140 x 0.20 = 28[6]))[5]	48
(4)	Services @ 100%[7]	1,161
(5)	Net expenditures abroad[7]	-2
(6)	Total consumer expenditure on goods and services produced in Alberta (1+2+3+4+5)	1,892
(7)	Total consumer expenditure on goods and services[7]	2,984
(8)	Regional content of consumer spending on goods and services (6÷7)	0.63

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5. Alberta Bureau of Statistics, Industry and Resources, 1978-79, Table 65, p. 102.

6. Alberta exports about 80 percent of petroleum and petroleum procuts. Therefore, only 20 percent will be consumed in Alberta: Industry and Resources, 1978-79, p. 83.

7. Alberta Bureau of Statistics, Alberta Economic Accounts, 1976, Table 13, pp. 48-49.

APPENDIX III

LIST OF INDUSTRIES WITH QUALIFIED AND ASSURED GROWTH PROSPECTS

Industries with qualified growth prospects:

Slaughtering and Meat Packing
Processed Cheese Manufacturers
Fish Products Industries
Fruit and Vegetable Canners and Preservers
Feed Mills
Sugar Refineries
Vegetable Oil Mills
Distilleries
Shoe Factories
Carpet Mat and Rug
Other Knitting Mills
Men's Clothing
Women's Clothing
Children's Clothing
Foundation Garments
Other Clothing Industries
Household Furniture
Office Furniture
Miscellaneous Furniture
Pulp and Paper Mills
Other Paper Converters
Iron and Steel Mills
Steel Pipe and Tube Mills
Smelting and Refining
Agricultural Implements
Aircraft and Parts
Motor Vehicle Manufacturers
Glass and Glass Products
Mixed Fertilizers
Plastics and Synthetic Resins
Paints and Varnishes

Industries with assured growth prpspects:

a.

Poultry Processors
Dairy Factories
Biscuit Manufacturers
Soft Drink Manufacturers
Breweries
Leather Tanneries
Leather Glove Factories
Veneer and Plywood Mills
Paper Box and Bag
Iron Foundries
Aluminum Rolling and Casting
Boiler and Plate Works
Heating Equipment Manufacturers
Misc. Vehicle Manufacturers
Communications Equipment
Battery Manufacturers
Cement Manufacturers
Gypsum Products
Petroleum Refineries

b. Industries with good growth prospects:

Bakeries
Misc. Food Industries
Tire and Tube Manufacturers
Sawmills
Misc. Wood Industries
Oranmental and Architectural Metal
Misc. Metal Fabricating
Misc. Machinery and Equipment
Motor Vehicle Parts and Accessories
Electrical Industrial Equipment
Industrial Chemicals
Scientific and Professional Equipment
Plastic Fabricators NES
Signs and Displays

c. Industries with major growth prospects:

Sash, Door and Planning Mills
Commercial Printing
Plate Making and Type-setting
Publishing Only
Printing and Publishing
Fabricated Structural Metal
Metal Stamping, Pressing and Coating
Machine Shops
Truck Body and Trailer Manufacturers
Concrete Products Manufacturers
Ready-Mix Concrete

SOURCE:

Hedlin, Menzies and Associates Ltd., Opportunities for Manufacturing, Prairie Region to 1981, pp. 215, 216 and 222.

APPENDIX IV

JOINT AOSTRA-INDUSTRY RESEARCH PROJECTS

(i) In-situ oil recovery projects:

Partner	Area	AOSTRA Funding	Project
Shell Canada Resources Ltd.	Peace River	$29 million for 50% share	Cyclic pressurization and depressurization with steam.
Amoco Canada Petroleum Co. Ltd.	Athabasca	$23 million for 50% share	Amoco's COFCAW Process (forward combustion and water flood).
BP Exploration Canada Ltd.	Cold Lake	$8.5 million for 50% share	Steam stimulation followed by combustion displacement.
Numac Oil and Gas Ltd.	Athabasca	$1.2 million for 75% share	Exploratory fracturing program to improve horizontal communication.
In-Situ Research and Engineering Ltd.	Athabasca	100% Funding of Initial Laboratory Program	Shallow deposit heating program.
Research Council of Alberta		$2.8 million	Formation test beds for testing and support of larger pilot projects.
Industry Group		Cost sharing basis	Feasibility of shafts and tunnels for access to deposits.
Pacific Petroleums Ltd.	Lloydminster	$11.8 million for 50% share	Steam stimulation, air injection and combustion.
Husky Oil Operations Ltd.	Lloydminster	$1.3 million for 50% share	Steam stimulation.

(ii) Upgrading research:

Process	AOSTRA Funding	Project
Hydrocracking	Not Known	Studies on hydrocracking of oil sands bitumen and Lloydminster-type heavy oil seeking higher liquid yield, using Government of Canada hydrocracking technology.
Flexicoking	$750,000	Conversion of coke to low BTU fuel gas to assist removal of sulphur by means of Exson's flexi-coking process.
Retorting	$3.0 million	Taciuk process for retorting bitumen from oil sand using proprietary rotating, heated kiln.
Retorting	Not Known	Evaluation of Lurgi direct dry distillation process.
Heavy Oil Cracking	$586,000	Pilot plant studies of bitumen cracking for production of petrochemical feedstocks - To be carried out by Alberta Research Council in co-operation with Mitsubishi Petrochemical Company.

SOURCE:

Corbet, B., "Alberta to Become the Worldwide Authority on Oil Sands Recovery Technology", Mini-Pegg, Association of Professional Engineers, Geologists and Geophysicists of Alberta, August 1978, pp. 3 and 4.

APPENDIX V

OUT-OF-PROVINCE EXPLORATION AND DEVELOPMENT ACTIVITIES OF THE PETROLEUM FIRMS HEADQUARTERED IN ALBERTA

Foreign Ownership %	Firm Name	Head Office Location	Areas of Activity Outside Alberta
100	Mobil Oil Canada Ltd.		
100	Amoco Canada Petroleum Co.		
45.2	Dome Petroleum Ltd.	Calgary	Arctic Alaska North Sea
53.1	Hudson's Bay Oil and Gas Co.	Calgary	British Columbia Saskatchewan
100	Texaco Exploration Canada Ltd.		
83.4	Ashland Oil Canada Ltd.		
96.3	Great Canadian Oil Sands Ltd.		
53	Canadian Superior Oil Ltd.	Calgary	Indonesia Australia Tunisia Gulf of Mexico North Sea Beaufort Sea (Arctic) Western Provinces
77.4	Murphy Oil Co.		
78.9	Aquitaine Co. of Canada	Calgary	Alaska North Slope Beaufort Sea Offshore Labrador
N.A.	Home Oil Co.	Calgary	Alaska North Slope European Offshore
86.7	Union Oil Co. of Canada		
100	Atlantic Richfield Canada Ltd.		
N.A.	United Canso Oil and Gas Ltd.	Calgary	North Sea
N.A.	Bow Valley Industries	Calgary	MacKenzie Delta 17 Foreign Countries
48.3	Pacific Petroleum	Calgary	British Columbia
N.A.	Ranger Oil (Canada) Ltd.	Calgary	North Sea Sable Island Louisiana

Foreign Ownership %	Firm Name	Head Office Location	Areas of Activity Outside Alberta
N.A.	Numac Oil and Gas Ltd.	Edmonton	North Sea MacKenzie Delta Western Canada
N.A.	Asamera Oil Corp. Ltd.	Calgary	Indonesia Manitoba
N.A.	Scurry-Rainbow Oil Ltd.	Calgary	British Columbia North Sea MacKenzie Delta
N.A.	Sunningdale Oils Ltd.	Calgary	North Sea Abu Dhabi
N.A.	Canadian Industrial Gas and Oil Ltd.	Calgary	Arctic Island North Sea MacKenzie Delta
N.A.	Canada Southern Petroleum Ltd.	Calgary	Arctic Island Yukon Northwest Territories British Columbia New Zealand
N.A.	Chieftain Development Co. Ltd.	Edmonton	North Sea Colombia Australia
N.A.	Western Decalta Petroleum Ltd.	Calgary	MacKenzie Delta Indonesia Off-Shore Texas North Sea
N.A.	Peyto Oils Ltd.	Calgary	North Sea Tunisia Guyana Off-Shore Gambia
N.A.	Alberta Eastern Gas Ltd.	Calgary	British Columbia Saskatchewan

SOURCE: Financial Times of Canada, Economic Forecast and Top Hundred 1974 Canadian Stocks, Toronto, pp. 3-25.
Financial Post, Friday, August 7, 1976.
Financial Post, The 1978 Ranking of Canada's Largest Companies, Summer 1978, pp. 8-15.

NOTES:
1. Areas of activities outside Alberta are for the year 1973 and before.
2. Foreign ownership percent has been updated from 1973 original data to available 1978 data.
3. N.A. means not available.